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A MONOGRAPH
OF THE
DEVONIAN FAUNA
OF THE
SOUTH OF ENGLAND.

BY
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PART IV.

THE FAUNA OF THE LIMESTONES
OF
LUMMATON, WOLBOROUGH, CHIRCOMBE BRIDGE, AND CHUDLEIGH.

PAGES 251—344; PLATES XXV—XXXI.

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? 1850.	EUOMPHALUS	RETORSUS, <i>F. A. Römer</i> .	Beitr., pt. 1, p. 15, pl. iii, figs. 15 <i>a, b</i> .
1853.	—	ANNULATUS, <i>Sandberger</i> .	Verst. Rhein. Nassau, p. 211, pl. xxv, figs. 4, 4 <i>a—d</i> .
1853.	—	RETORSUS, <i>Sandberger</i> .	Verst. Rhein. Nassau, p. 213, pl. xxv, figs. 8, 8 <i>a, b</i> .
1854.	—	ANNULATUS, <i>Morris</i> .	Catal. Brit. Foss., p. 247.
? 1866.	—	RETORSUS, <i>F. A. Römer</i> .	Beitr., pt. 5, p. 8, pl. xxxiv, fig. 3.
? 1867.	—	LÆVIS, <i>Trenkner</i> .	Paläont. Novit., pt. 1, p. 7, pl. i, fig. 11.
1888.	—	ANNULATUS, <i>Eth</i> .	Foss. Brit., vol. i, Pal., p. 163.

Description.—Shell rather small, discoid, flat, of about five or six volutions. Spire flatly concave, umbilicus large and still deeper; suture deep and very well defined, facing upwards. Whorls increasing very slowly, almost circular in section, slightly compressed perpendicularly; regularly rounded, ornamented with fine transverse threads divided by similar furrows which are very clear to the naked eye in the full-grown shell. Mouth unknown.

Size.—Height 4·5 mm., width 14 mm.

Locality.—There is a finely preserved specimen as well as a much larger cast in the Museum of Practical Geology, and two poorer examples in Mr. Vicary's Collection, from Wolborough.

Remarks.—The best specimen at Jermyn Street I have no hesitation in regarding as the type specimen of *Eu. annulatus*, Phillips. It has the same number of whorls, but the body-whorl is more defective than in his figure, and the striæ are much finer and more numerous. On consulting Mr. E. T. Newton, he agreed with me that there is every probability of its being the type specimen, and that the injury near the mouth is to be accounted for by its having been detached from the matrix and mended.

The second specimen in the same Museum is the cast of a much larger shell, and has been there labelled *Euomphalus planorbis*, d'Arch. and de Vern.; but a small remaining fragment of the test shows that in all probability it belonged to the present species.

One of Mr. Vicary's specimens is in a peculiar state of preservation, and is so misleading that for a long time I regarded it as quite a different kind of shell. It is the inside surface of the spiral face of the shell, with the partitions rubbed away, and looks very like a low sinistral shell; but on a close examination its true character is unmistakably evident, and, where chips of the shell are removed, the marking is seen exactly to correspond with that of the present species, with which I have, therefore, no hesitation in classing it.

Goldfuss's figure has much finer striæ than has Phillips's, and we might even be inclined to class it with *Ph. serpens* but for its much more numerous whorls.

Eu. retrorsus, F. A. Römer,¹ seems only to differ in having fewer and more quickly increasing whorls. In a subsequent part of his work Römer² figures a variety with fewer striæ and more slowly increasing whorls. If these two are really only varieties of the same species, it is almost certain that that species must be the same as Phillips's, as the points of difference are not permanent in the two specimens. Sandberger³ identifies with Römer's shell a small cast which may very well belong to the present form.

Eu. annulatus, Sandberger, seems to agree exactly with Phillips's type, but it has a bifurcation and diminution of the ridges on the back which are not discernible on Phillips's shell, though from its bad state of preservation it is quite possible that they originally existed.

Affinities.—This species is distinguishable from *Ph. serpens*, sp., Phillips, by the larger number of its volutions, its narrower and more slowly increasing whorls, and by its more prominent and coarser markings.

Eu. germanus, Phillips, sp., differs from *Eu. annulatus*, Phillips, and all the other English species of these localities by having spiral threads which form reticulations with the longitudinal lines.

6. EUOMPHALUS NEAPOLITANUS, n. sp. Pl. XXIV, figs. 12, 12 a.

Description.—Shell rather small, flat, discoid, obliquely coiled in about five slowly increasing volutions. Spire concave. Suture rather deep, facing upwards. Whorls nearly circular in section, slightly flattened on the back, and bearing on their highest point a flat sulcus bounded by indistinct ridges. Ornament (of the inner whorls) consisting of fine, close, rounded ribs or striæ, tending slightly backwards, and not deflected on the sulcus. Shell-structure thick.

Size.—Height about 6 mm., width 21 mm.

Locality.—Wolborough. A single specimen is in Mr. Vicary's Collection.

Remarks.—As the only specimen of this shell is almost entirely a cast, and the ornament is only preserved upon the inner whorls, its description must be regarded as somewhat uncertain, for it cannot be asserted that the character of the markings does not change upon the body-whorl. As far as can be judged, however, it clearly belongs to the genus *Euomphalus*, as there are no signs whatever of any arching of the ornament that might indicate the existence of a sinus-band.

Affinities.—This shell bears a very close resemblance to *Pleurotomaria euom-*

¹ 1850, F. A. Römer, 'Beitr.,' pt. 1, p. 15, pl. iii, figs. 15 a, b.

² 1866, *ibid.*, pt. 5, p. 8, pl. xxxiv, fig. 3.

³ 1853, Sandberger, 'Verst. Rhein. Nassau,' p. 213, pl. xxv, figs. 8, 8 a, 8 b.

phalus, Sandberger,¹ and for a long time I was disposed to regard it as a specimen of it; but a closer examination causes me to believe that it is generically distinct from it, for in that shell the striæ are very strongly deflected across the sinus-band, while in the present species they appear to be perfectly straight.

It is also very similar to *Euomphalus acuticosta*, Sandberger,² but it is easily distinguished from it by possessing a broad depression on its shoulder instead of a single sharp keel. It differs from *Schizostoma vittatum*, Goldfuss,³ not only in the absence of a sinus-band, but by the coarseness of its ornamentation; while *Sch. tæniatum*, Goldfuss,⁴ and *Sch. fasciatum*, Goldfuss,⁵ are also distinguished by the possession of a few more spiral depressions.

From *Ph. serpens* and *Eu. annulatus* the angulation of the whorls caused by the sulcus at once distinguishes it.

7. EUOMPHALUS ? ARANEIFER, n. sp. Pl. XXIV, fig. 13.

Description.—Shell small, spiral, flat, sinistral. Apex depressed. Spire of few angulated whorls. Suture deep, wide. Section of whorls rising from the suture in a small angulated ridge, followed by a narrow groove, from which it again rises to a higher ridge, followed by a linear constriction, from which it slopes convexly downward for a rather wider interval to another small ridge, after which it appears to sink perpendicularly. Surface covered with fine, close, prominent, rounded, longitudinal ridges.

Size.—Width about 12 mm.

Locality.—Lummaton. There is a single poor specimen in my collection.

Remarks.—The fossil above described is so poor and obscured that but very little can be ascertained about its nature. It seems most probably to be a *Euomphalus*, and I have therefore placed it provisionally in that genus, but it may possibly prove to belong to something quite different. It is, in fact, so confused with the subcrystalline matrix that neither Mr. Roberts nor I feel certain whether it is the surface or the external cast of a shell, and if the latter were the case the description would of course have to be reversed.

Affinities.—Mr. Roberts and I, on examining it together, came to the conclusion that it very nearly resembled in its aspect *Pleurotomaria euomphalus*, Sandberger, but that it evidently did not belong to that species, inasmuch as it showed no signs of a sinus-band, and therefore was not a *Pleurotomaria*.

¹ 1853, Sandberger, 'Verst. Rhein. Nassau,' p. 187, pl. xxii, figs. 12, 12 a.

² Ibid., p. 210, pl. xxv, fig. 2.

³ 1844, Goldfuss, 'Petref. Germ.,' vol. iii, p. 79, pl. clxxxviii, figs. 6 a, b.

⁴ Ibid., p. 79, pl. clxxxviii, figs. 4 a—c.

⁵ Ibid., p. 79, pl. clxxxviii, figs. 5 a, b.

From *Euomphalus acuticosta*, Sandberger,¹ which equals *Eu. Schnuri*, d'Archiac and de Vern.,² it is distinguished by the presence of the ridge and groove close to the suture, and by several other features.

8. EUOMPHALUS FENESTRALIS, *Whidborne*. Pl. XXV, figs. 1—3.

1841. EUOMPHALUS SERPENS, *Phillips* (pars). Pal. Foss., p. 94, pl. xxxvi, fig. 172f (only).
 1889. — CATENULATUS, *Whidborne* (not *Hisinger*). Geol. Mag., dec. 3, vol. vi, p. 30.
 1889. — FENESTRALIS, *Whidborne*. Ibid., dec. 3, vol. vi, p. 30.

Description.—Shell small, flat, discoidal, of four whorls. Apex sunk about one-third of the height of the shell. Spire flatly concave. Suture excavate, narrow, deep, facing upward, crenulated by the ornament. Whorls increasing rapidly, irregularly hexagonal or polygonal in section; an imaginary horizontal plane through the apex almost exactly passing through the suture and the shoulder of the shell; the part of the whorls above this plane being about one-fourth the total height of the whorl, and divided into three shallow grooves by two central ridges, which are rather closer to each other than to the ridge on the shoulder, and to a similar ridge immediately in front of the suture. Ridge of shoulder defined above, confluent below. Section of whorl below the above-mentioned plane bluntly trigonal, and about two-thirds the height of shell. Ornament consisting of small, very elevated, rounded ridges or cords, separated by rather wider, deep channels, and swelling almost into nodules on the ridges, rising from the suture, crossing the supersutural ridge and inner furrow perpendicularly, bent backwards very slightly over the central furrow and very greatly over the external furrow, vanishing (almost completely) upon the oblique flat back below the shoulder, and becoming very large, prominent, and rounded on the blunt angle and sides of the umbilicus. Umbilicus very large, wide, and deep, composed of the regularly convex inner sides of the whorls (which are there of a nearly circular curvature), divided by a deep linear suture, and ornamented by strong, subangular, prominent, elevated, transverse ridges, which are separated by deep furrows, and radiate directly on every side straight from the lower side of the nucleus or apex. Mouth small, subpolygonal. Shell-structure probably thick.

Size.—Height 5 mm., width 13 mm.

¹ 1853, Sandberger, 'Verst. Rhein. Nassau,' p. 210, pl. xxv, fig. 2.

² 1842, d'Arch. and de Vern., 'Geol. Trans.,' ser. 2, vol. vi, pt. 2, p. 364, pl. xxxiv, figs. 7, 7 a, 7 b.

Localities.—Of the upper face or exterior of the shell there are two specimens in Mr. Vicary's Collection from Wolborough; another in the British Museum from Wolborough; and three others in the Torquay Museum, which seem to have come from Lummaton.

Of the umbilicus there is a fine specimen in my collection, and two in the British Museum, one of which, in the Lee Collection, was figured by Phillips as a specimen of his *Euomphalus serpens*. These three specimens are all from either Lummaton or Barton.

Remarks.—In the above enumeration are given two series of shells, one of which shows the spire and the other the umbilicus. Generally speaking, these specimens do not give any indications that the two series belong to the same shell, but one of the Torquay Museum specimens of the first series shows enough of the umbilicus to prove that there is every reason to suppose that it is identical with those which are visible in the second series of fossils. Therefore, although I originally treated them as distinct in the 'Geological Magazine,' I now feel obliged to group them together. It only remains to remember that similarity of the umbilicus, though it suggests, may not prove, identity, as two distinct fossils might have an exactly similar umbilicus, and therefore that further evidence may show that after all the two species are distinct.

Having regard first to the group of specimens that show the spire, we observe that they belong to a very beautiful and distinct species. Mr. Roberts and myself compared it with all the species of *Euomphalus* mentioned in d'Archiac and de Verneuil's list, and found it quite unlike any of them, and there is nothing like it in any of the later writers whom I have been able to consult.

Its upper surface somewhat resembles the original figure of *Euomphalus germanus*, Phill., sp.,¹ and as such one of the specimens in Mr. Vicary's Collection was labelled by Salter. From that shell, however, it distinctly differs in the arrangement of the ornament and the shape of its section.

The specimen in the British Museum is there labelled *Pleurotomaria euomphalus*, Sandberger,² but to that species the present shell clearly does not belong. Though very similar in general shape, the central furrow is much broader and is not marked as a sinus-band, so that it evidently is not even of the same genus of shell.

For these specimens I proposed the name of *Euomphalus fenestralis* in the 'Geological Magazine,' 1889.

Turning to the group of specimens showing only the umbilicus, we find that with regard to them the question of nomenclature is much more difficult.

Mr. Lee's specimen, now in the British Museum, is the original of one of

¹ 1841, Phillips, 'Pal. Foss.,' p. 118, pl. xlviii, fig. 226.

² 1852, Sandberger, 'Verst. Rhein. Nassau,' p. 187, pl. xxii, figs. 12, 12 a.

Phillips's figured types of his *Eu. serpens*, fig. 172 *f* (only). At page 222 he says of this and fig. 172 *g*, "They have a different aspect from the rest;" and, in fact, they evidently differ specifically from the shell, described by him and represented by his figs. 172 *a*, *b*, which we have taken for the type of his restricted species, *Eu. serpens*. There is also reason to suppose that his fig. 172 *g* represents a different species, so that only his fig. 172 *f* belongs to the specimens which we are now discussing. For these specimens I proposed the name of *Eu. catenulatus*, in the 'Geological Magazine' for January, 1889; but since then it has become evident that *Eu. fenestralis* has the strongly ribbed umbilicus which is distinctive of these specimens, and therefore there is every reason to suppose that the two species are synonymous.

Affinities.—*Euomphalus Labadyi*, d'Arch. and de Vern.,¹ differs in having a single keel, and no transverse ridges on the upper surface, while it bears very similar radiating, rounded ridges on the umbilicus and base. These authors quote it from Newton, but I have not seen any fossil agreeing with it from that locality.

Euomphalus concavus, F. A. Römer,² has a median sulcus, but its whorls are much more rounded, without the strong spiral ridges, and it does not seem to possess any strong longitudinal bars upon the umbilicus.

9. EUOMPHALUS GERMANUS, *Phillips*, sp. Pl. XXV, figs. 4, 4 *a*, 5, 5 *a*, 5 *b*.

1841. NAUTILUS GERMANUS, *Phillips*. Pal. Foss., p. 118, pl. xlviii, fig. 226.

1853. EUOMPHALUS DECUSSATUS, *Sandberger*. Verst. Rhein. Nassau, p. 210,
pl. xxv, figs. 3, 3 *a*, 3 *b*.

1854. NAUTILUS GERMANUS, *Morris*. Cat. Brit. Foss., p. 308.

1888. — — *Etheridge*. Foss. Brit., vol. i, Pal., p. 168.

1889. EUOMPHALUS GERMANUS, *Whidborne*. Geol. Mag., dec. 3, vol. vi, p. 30.

1889. — DECUSSATUS, *Whidborne*. Ibid., dec. 3, vol. vi, p. 30.

Description.—Shell small, discoid, apparently asymmetrical, elliptically coiled in three or four slowly increasing whorls. Spire sunk below the summit of the body-whorl, almost unseen, but apparently marked very similarly to the base. Suture wide and rather deep. Whorls subcircular or subquadrate in section, flattened on the back, which is broad, and defined above and below by spiral ridges, and is microscopically reticulate. Ornament of the base, between the lower keel and the suture, consisting of five or six similar low, rounded, distant,

¹ 1842, d'Arch. and de Vern., 'Geol. Trans.,' ser. 2, vol. vi, pt. 2, p. 362, pl. xxxiii, figs. 6, 6 *a*, 6 *b*.

² 1852, F. A. Römer, 'Beitr.,' pt. 2, p. 74, pl. xi, fig. 21.

spiral ridges, crossed by numerous smaller transverse lines. Umbilicus very wide and shallow. Peristome thickened. Whorl sometimes bearing a transverse varix at some distance behind the mouth.

Size.—Height 8 mm., width 25 mm.

Locality.—Wolborough. Phillips's type is in the Museum of Practical Geology, and there is another specimen in the Woodwardian Museum.

Remarks.—This species was regarded by Phillips as a *Nautilus*. He compared it with *N. sulcatus*, Sowerby,¹ *N. subsulcatus*, Phillips,² and *N. quadratus*, Fleming;³ but from all these species it differs very widely. In fact, the similarity, such as it is, is entirely superficial. The section given by Phillips (fig. 226 *b*) is a restoration, and, after a careful examination of his type specimen by Mr. E. T. Newton and myself, we came to the conclusion that it was incorrect, and that there was no evidence that the fossil was a Cephalopod. It appeared to me that it evidently belonged to the genus *Euomphalus*.

The specimen in the Woodwardian Museum has been labelled by Mr. E. B. Tawney *Euomphalus decussatus*, Sandberger; and with that species it clearly agrees, and as such was recorded by me in the 'Geological Magazine' of 1889. At that time I had not had an opportunity of comparing the two English specimens, but since then the authorities of the two Museums have most kindly placed them in my hands for figuring, and upon laying them side by side it becomes at once clear that they belong to the same species, and therefore Sandberger's name becomes a synonym of Phillips's.

In consequence of some features in the type specimen, I was much inclined to describe it as a sinistral shell, but as that fossil has evidently suffered from some squeezing and distortion, and as the Woodwardian example and Sandberger's figure both point to its being dextral, it has seemed to be safer to treat it as such. Thus both the English specimens must be regarded as showing the base of the shell. The markings of its upper surface are, however, well shown in Sandberger's figure; and from it we learn that the upper side of the spire was less concave than the base, that its sutures were shallower, and that its ornamentation was almost exactly the same.

Affinities.—In *Eu. araneifer* the ornamentation is very much closer and finer. I am not aware of any other species that could be mistaken for this shell.

¹ 1827, Sowerby, 'Min. Conch.,' vol. vi, p. 137, pl. dlxxi, figs. 1, 2.

² 1836, Phillips, 'Geol. Yorkshire,' pt. 2, p. 233, pl. xvii, figs. 18, 25.

³ 1828, Fleming, 'Hist. Brit. Anim.,' p. 231.

10. EUOMPHALUS ROTA, *Sandberger*. Pl. XXV, figs. 6—8.

1841. EUOMPHALUS RADIATUS, *Phillips* (not *Goldfuss* MS.). Pal. Foss., p. 138,
pl. lx, fig. 171*.
1853. — ROTA, *Sandberger*. Verst. Rhein. Nassau, p. 212, pl. xxv,
figs. 5, 5 a—d.
1854. — RADIATUS?, *Morris*. Cat. Brit. Foss., p. 248.
1888. — *Etheridge*. Foss. Brit., vol. i, Pl., p. 163.
1889. — ROTA, *Whidborne*. Geol. Mag., dec. 3, vol. vi, p. 30.

Description.—Shell small, flat, discoidal, of numerous (five or six) volutions, elliptically coiled. Spire so much depressed below the plane of the exterior whorl as to be almost, if not quite, symmetrical with the base. Suture deep. Whorls rising convexly from the suture, shortly elliptic or almost circular in section, except where they are indented by the whorl within, but bearing upon the upper and lower elbows a sharp, raised, prominent, spiral keel or ridge, more confluent towards the back than towards the sides, so that the back of the whorls is almost flat. Surface, except on the keels, marked by multitudinous, close, fine, rounded, transverse threads, sloping slightly backwards from the suture to the keel. Mouth slightly expanded and much thickened round its margins. A varix sometimes crossing the whorl at about one-third of a volution behind the mouth.

Size.—Phillips's original specimen measures 8 mm. in height by 23 mm. in width. Another specimen is 9 mm. in height by 30 mm. in width.

Localities.—Wolborough; Lummaton (?). From the former locality there are four specimens in Mr. Vicary's Collection, five in the Museum of Practical Geology, of which one is Phillips's figured specimen, and one in the Torquay Museum. In the Torquay Museum are three specimens which most probably come from Lummaton, and there is one from Barton in the British Museum.

Remarks.—The nomenclature of this shell is rather intricate. In 1832 Goldfuss¹ catalogued without description a German shell under the name of *Euomphalus radiatus*. He, however, appears to have described it in manuscript, and from this description Phillips, in 1841, incorrectly identified the Devonshire specimens with Goldfuss's species.² Hence, though Phillips's species was actually published before that of Goldfuss, it does not seem right that it should appropriate a name only given to it by mistake; and therefore it must bear the name which, in 1853, Sandberger gave to other German shells which are undoubtedly identical with it.

The only difference between the English specimens and Sandberger's figure

¹ 1832, Goldfuss, in 'De la Beche Handbook,' p. 532.

² 1844, Goldfuss, 'Petref. Germ.,' vol. iii, p. 83, pl. clxxxix, fig. 14.

is that they are frequently coiled in an elliptic instead of a circular spire, but this does not seem a very constant character, as they are sometimes almost or quite round. The best of the specimens in the Torquay Museum is the only one which shows the fine transverse markings, and these agree exactly with those of Sandberger's figure. Phillips has supplied much coarser markings in his figure, which do not exist in his specimen, and which were probably due to his having confounded it with Goldfuss's shell, which is clearly distinct according to the description given of it by d'Archiac and de Verneuil.

Salter has evidently observed this distinction, as he labelled one of the specimens in Mr. Vicary's Collection, "*Vermetus*, sp. (*Euomphalus radiatus*, Phill., not Goldfuss)."

The species is very clearly defined by the squared appearance given to it by its two spiral keels, and by its very fine transverse striation. The former is not, however, perfectly symmetrical, as one of the keels appears to be slightly further from the suture than the other, so that the back of the whorls is somewhat oblique. On the inner whorls these keels are visible as a thread just inside the suture. The squared appearance is entirely due to these keels, for the whorls themselves are elliptic or subcircular in section both inside and out.

Affinities.—*Eu. Schnurii*, d'Arch. and de Vern.,¹ has much more rapidly increasing whorls, with a triangular rather than a circular section, and it has angulated elbows rather than raised keels.

In *Eu. radiatus*, Goldfuss, or *Schizostoma radiata*, d'Arch. and de Vern.,² the shell is less symmetrical, the transverse striæ more arched and coarser above, the upper keel very much more elongated and the whorls deeper in section.

3. *Genus*.—PHANEROTINUS, Sowerby, 1842.

This genus only differs from *Euomphalus* in having its whorls free; and as in some species the apical whorls are united, it may be doubted whether the distinction is of permanent value. Shells of this genus were included by de Koninck under *Euomphalus*. *Ecculiomphalus*, Portlock, 1843, and *Serpularia*, F. A. Römer, 1843, are synonyms.

1. PHANEROTINUS MILITARIS, n. sp. Pl. XXV, figs. 9—11.

1853. EUOMPHALUS SERPULA, Sandberger. Verst. Rhein. Nassau, p. 214, pl. xxv, fig. 9.

1884. ECCULIOMPHALUS SERPULA, Tryon. Structural Conchology, vol. ii, p. 220, pl. lxx, fig. 20.

¹ 1842, d'Arch. and de Vern., 'Geol. Trans.,' ser. 2, vol. vi, pt. 2, p. 364, pl. xxxiv, figs. 7, 7 a, 7 b.

² Ibid., ser. 2, vol. vi, pt. 2, p. 364, pl. xxxiv, figs. 3, 3 a, 3 b.

1889. EUOMPHALUS SERPULA. *Whidborne*. Geol. Mag., dec. 3, vol. vi, p. 30.

Description.—Shell rather large, more or less lenticular or discoid, elliptically coiled in a few free and very distant whorls. Apex unseen, probably free. Spire sometimes lying in the same plane with, or even depressed below, the plane of the mouth, and sometimes somewhat elevated above it; consisting apparently of about two volutions, which increase with considerable rapidity, and are separated from each other by a much greater distance than their greatest diameter. Whorls almost exactly circular in section, marked by numerous close, rather prominent but indistinct, straight, irregular growth-striæ, which tend rather rearward from the inner to the outer side of the whorl. Shell-structure rather massive.

Size.—A specimen measures 9 mm. in height by 35 mm. in width and 25 mm. in breadth. Other specimens are found considerably larger.

Localities.—From Wolborough there are two specimens in the Torquay Museum, two specimens in the British Museum, three in the Museum of Practical Geology, two in the Woodwardian Museum, and two in Mr. Vicary's Collection. From Lummaton (?) there is one specimen in the Torquay Museum and several fragmentary specimens in my Collection.

Remarks.—This species appears to be moderately common at Wolborough. In shape it is a long, rapidly increasing, circular tube, loosely coiled once or twice in an elliptic curve, so that the spaces between the whorls are generally very much greater than the diameter of the whorls themselves, though not increasing in the same ratio. There does not appear to be any tightening of the coiling towards the apex, which seems situated some distance from the middle point of the ellipse, but it is possible that the true apex is lost in the specimens observed. The increase in the diameter of the tube appears to be about four times its size in the course of a volution. The surface is not particularly well preserved in any of the specimens, but in some of those from Lummaton it is sufficiently retained to show that it had no ornamentation except close indistinct and irregular striæ or growth-lines, which crossed the whorls a little obliquely but without undulations or angles. The coiling of the spire seems to vary in elevation, being sometimes nearly in one plane, and sometimes raised so as to form the skeleton of a low cone.

A comparison of the figures of *Eu. serpula*, de Koninck, given by foreign authors leads to the impression that more than one Devonian species has been incorrectly described under that name. The present shell appears to agree specifically with the figure given by Sandberger, which differs, however, in having numerous central whorls. It is subject to so little variation, and is so individualized in general appearance, that we cannot regard it as identical with any of the other figures of foreign examples of *Eu. serpula* which we have examined.

Affinities.—The original *Eu. serpula*, de Koninck,¹ is a Carboniferous shell, and seems to differ from this species in being more regularly and closely coiled and in having two narrow distant spiral grooves upon its upper surface. Its apical whorls are rather elevated.

Goldfuss's figures of *Eu. serpula*² are distinguished by being circularly and much more closely coiled. Their whorls show nearly the same rate of increase as do those of the present shell. De Koninck considers that only Goldfuss's var. *teres* (1 *a* and 1 *e*) belong to his species.

Euomphalus vermilia, Goldf.,³ is distinguished by its more slowly increasing whorls, and by the possession of four spiral striæ.

Ph. intermedius, de Koninck,⁴ and *Ph. Archimedis*, de Koninck,⁵ are also distinguished by their circular coiling and spiral striæ.

Ph. laxus, Hall,⁶ differs in being circularly and more regularly coiled, in being marked with much coarser and more distant striæ, in being on the whole slower in its rate of increase, and in having a slightly expanded mouth.

2. PHANEROTINUS MUNDUS, n. sp. Pl. XXV, figs. 12, 13.

1842. EUOMPHALUS SERPULA, *d'Arch. and de Vern. (pars)* (not de Koninck).
Geol. Trans., ser. 2, vol. vi, pt. 2,
p. 363, pl. xxxiii, fig. 9 (only).

Description.—Shell small, discoid, flat, circularly coiled, slowly increasing; apex very minute. Spire free, almost flat above, consisting of about three or four volutions, comparatively closely coiled, the distance of each whorl from that within being about a quarter its breadth. Whorls nearly circular in section, smooth or marked only by indistinct growth-lines.

Size.—A small specimen measures in height 1·5 mm., in width 5 mm.

Localities.—There is a specimen in the Museum of Practical Geology from Wolborough, and two small specimens perhaps from Lummaton in the Torquay Museum.

Remarks.—These shells present very few points for definition. They are characterised by their whorls being free from the apex, and yet coiled in close proximity. The rate of increase seems to be decidedly slow. The best Torquay

¹ 1842-4, de Koninck, 'Desc. Anim. Foss.,' p. 425, pl. xxiii bis, figs. 8 *a*, *b*, and pl. xxv, fig. 5, and 1883, de Koninck, 'Ann. Mus. Royal H. N. Belg.,' vol. viii, pt. 4, p. 4, pl. xxii, figs. 1-3.

² 1844, Goldfuss, 'Petref. Germ.,' vol. iii, p. 86, pl. exci, figs. 1 *a*-*e*.

³ 1844, Goldfuss, 'Petref. Germ.,' vol. iii, p. 86, pl. exci, fig. 2.

⁴ 1883, de Koninck, 'Ann. Mus. Royal H. N. Belg.,' vol. viii, pt. 4, p. 5, pl. xxii, figs. 5, 6.

⁵ Ibid, p. 5, pl. xxii, figs. 7, 8.

⁶ 1861, Hall, 'Desc. New Species of Fossils,' p. 26.

specimen shows the shell as distinctly sinistral, with the upper surface of the whorls lying almost in one plane.

In some of the foreign species of this genus, while the apical whorls are closely coiled or even contiguous, the coiling becomes looser with the increase in size.¹ Hence, whether all the present fossils are full-sized specimens, or whether some are only the apical whorls of a larger species, cannot be decided until more numerous specimens are found. At present there is no reason against regarding them as full-grown shells. From the accompanying species they appear to be distinct, as in the former the coiling is very much looser even to the apex. In *Ph. militaris*, moreover, the rate of increase of the whorls is very much greater.

At first sight this species seems identical with *Eu. retrorsus*, F. A. Römer,² as given by Sandberger;³ but his enlarged figure is only that of a cast, and a reference to Römer's original description shows that his species is very different, and that its whorls are contiguous instead of being free.

One of the examples of *Eu. serpula* figured by d'Archiac and de Verneuil⁴ is so similar that it may belong to the same species, though it appears to differ in having the central whorls in contact.

Both de Koninck⁵ and d'Archiac and de Verneuil quote each other in their original description of their species. It would seem probable that that of the latter authors was published first; but, as they ascribe the species to de Koninck, and he claims it as his own, his must be regarded as the authoritative description. Moreover, in his later work,⁵ de Koninck states that the French authors were incorrect in their identification of their shell with his. He considers that *Euomphalus serpula*, var. *gracilis*, of Goldfuss, is one of the Devonian species described by them under his name, and says that it should bear the name of *Ph. gracilis*. Although, as he first described it, there is no appreciable difference in *Ph. serpula* from our shell, his latter description shows that it differs by bearing one or two spiral striæ.

Euomphalus approximatus, de Koninck,⁶ is so similar that I was at first inclined to regard it as identical. It differs, however, in having a very decidedly elevated spire, and therefore, remembering the difference of the formation, it is best to regard it as distinct.

As given by Goldfuss, *Eu. serpula*, de Kon., var. *gracilis*, probably differs from

¹ The figure of our small Lummaton specimen (fig. 13) seems to show this character. This appearance is deceptive, and is due to the light in which this specimen was drawn. The outer whorl should have been represented as wider, and closer to the next within.

² 1850, F. A. Römer, 'Beitr.,' pt. 2, p. 15, pl. iii, fig. 15.

³ 1853, Sandberger, 'Verst. Rhein. Nassau,' p. 213, pl. xxv, figs. 8, 8a, 8b.

⁴ 1842-4, de Koninck, 'Desc. Anim. Foss.,' p. 425, pl. xxiii bis, figs. 8a, b.

⁵ 1883, de Koninck, 'Ann. Mus. Royal H. N. Belg.,' vol. viii, pt. 4, p. 4, pl. xxii, figs. 1-3.

⁶ Ibid., p. 6, pl. xxii, figs. 14a, b.

our shells in having the outer whorls more loosely coiled, while the apical whorls are in contact, and in its rate of increase being decidedly greater; while *Eu. serpula*, de Kon., var. *compressus*, Goldfuss, is distinguished by its section being very widely elliptic instead of circular.

3. PHANEROTINUS CENTRIFUGUS, *F. A. Römer*, sp.

1842. EUOMPHALUS SERPULA, *d'Arch. and de Vern.* (pars). Geol. Trans., ser. 2, vol. vi, pt. 2, p. 363, pl. xxxiii. figs. 9 *a*, 9 *b* (only).
 1843. SERPULARIA CENTRIFUGA, *F. A. Römer*. Verst. Harzgeb., p. 31, pl. viii, fig. 13.
 1844. EUOMPHALUS SERPULA, var. GRACILIS, *Goldfuss*. Petref. Germ., vol. iii, p. 86, pl. exci, figs. 1 *b* (only).
 ? 1861. — LAXUS, *Hall*. Desc. New Species of Fossils, p. 26.
 ? 1862. — — — Fifteenth Rep. N. Y. State, Cab. Nat. Hist., p. 54, pl. vi, fig. 2.
 1876. — SERPULA, *F. Römer*. Leth. Pal., pl. xxxii, fig. 10.
 ? 1876. ECCULIOMPHALUS ? LAXUS, *Hall*. Ill. Dev. Foss. Gast., pl. xvi, figs. 16—18.
 ? 1876. — COMES, *Hall*. Ibid., pl. xvi, figs. 8, 9.
 ? 1879. — LAXUS, *Hall*. Pal. N. Y., vol. v, pt. 2, p. 60, pl. xvi, figs. 8, 9, 16—18.
 1884. PHANEROTINUS CENTRIFUGUS, *Clarke*. Neues Jahrb. f. Min., Beil.-Band iii, p. 359.
 1887. — SERPULA, *Tschernyschew*. Mém. Com. Géol. Russ., vol. iii, No. 3, p. 38.

Description.—Shell rather large, flat, circularly coiled in a few slowly increasing volutions. Spire almost in one plane, and very loosely coiled, the whorls being separated from each other by a much greater distance than their diameter. Whorls circular in section, marked by numerous close, indistinct, straight, irregular growth-striæ, which are perpendicular to the inner side of the whorl, but incline rather rearward upon its back.

Size.—Height 10 mm., width 50 mm.

Locality.—There is a specimen from Barton or Lummaton in the Torquay Museum, and another from Wolborough in the British Museum.

Remarks.—The slowness of increase and the regular circular coiling seem to distinguish this shell from *Phanerotinus militaris*; the differences are so well marked that it seems necessary to separate them, although the English material is so poor that the present species cannot be fully defined.

It is less certain whether the shell described as *Phanerotinus mundus* is distinct, as it is possible that it may represent the inner whorls of the same shell, as that of which the present fossil shows only the outer.

As far as can be judged from the very fragmentary specimens, it exactly agrees with the shell described as *Euomphalus serpula* by d'Archiac and de Verneuil (in part), which appears to be the same as *Serpularia centrifuga*, F. A. Römer. Clarke remarks that the apical whorls of this form are in contact.

There does not seem any great difference between the American form described by Hall as *Eu. laxus* and Römer's shell, but it appears to expand more rapidly, to be more coarsely ornamented, and to have a slightly expanded mouth; it is therefore probably distinct. In *Phanerotinus paradoxus*, Winchell,¹ the apical whorls are united and the base of the whorls more deeply convex.

VIII. *Family*.—TROCHIDÆ, d'Orbigny, 1837.

1. *Sub-family*.—TROCHINÆ, Swainson, 1840.

1. *Genus*.—PLAGIOTHYRA, gen. nov.

Shell conical, of few broad, rapidly increasing whorls, generally more or less nodulated or spirally ridged. Base convex or flattish. Mouth subcircular or subtriangular, obliquely situated, its upper angle being much in advance of the lower. Columella arched. Outer lip sharp. Inner lip flattened, diffuse, callous, bearing upon the centre of its inner side a large, prominent, transversely flattened tooth. Shell-structure massive.

The two shells described below, though very different in general shape, appear to belong to the same type, so that they may be generically united. Their most prominent feature seems to be the possession of a single large median tooth on the inner lip of an obliquely receding mouth. Thus they clearly belong to the Trochidæ, and come very close to the genus *Monodonta*, from which they are separated by the absence of denticulations in the outer lip, and the position and character of the tooth on the inner lip. The columella, also, is not truncated.

The genus *Turcica*² is distinguished from this by its very thin shell, and by the character of the teeth upon the columella; and the genus *Naticodon*,³ by its less oblique aperture and its globose naticiform shell.

The very great variety of the generic names given to *Pl. purpura*, d'A. and de Vern., sp., by different authors shows the difficulty that has been experienced in the attempt to fix its proper position. As it does not seem possible satisfactorily to allocate either it or its fellow-species to any known genus, the only course open has been to found a new genus for their reception.

¹ 1863, Winchell, 'Proc. Acad. Sci. Philad.,' p. 21.

² 1858, Adams, 'Genera Recent Mollusca,' vol. i, p. 423.

³ 1847, Ryckholt, 'Mélange. Pal.,' vol. i, p. 75.

1. *PLAGIOTHYRA PURPURA*, *d'Archiac* and *de Verneuil*, sp. Pl. XXV, figs. 14, 14a.

1832. *TURBO NODOSUS*, *Goldfuss*. In *De la Beche's Handbook*, German edition, p. 533 (*named only*).
1842. *MONODONTA PURPUREA*, *d'Archiac* and *de Verneuil*. *Geol. Trans.*, ser. 2, vol. vi, pt. 2, p. 358, pl. xxxii, fig. 15.
1842. *TURBO (MONODONTA) GRANOSUS*, *Sandberger*. In *Neues Jahrb. f. Min.*, 1842, p. 394, pl. viii B, fig. 8 a, b.
1844. *MONODONTA PURPURA*, *Goldf.* *Petref. Germ.*, vol. iii, p. 101, pl. cxcv, fig. 4.
1848. *TURBO GRANOSUS*, *Bronn*. *Handbuch*, vol. iii, p. 1320.
1849. *TROCHUS PURPURA*, *d'Orbigny*. *Prodrome*, p. 64.
1853. *LITTORINA PURPURA*, *Sandberger*. *Verst. Rhein. Nassau*, p. 221, pl. xxv, figs. 17—19.
1866. *MONODONTA PURPURA*, *Giebel*. *Repertorium*, p. 105.
1889. *LITTORINA PURPURA*, *Whidborne*. *Geol. Mag.*, dec. 3, vol. vi, p. 30.

Description.—Shell small, turbiniform, of few volutions. Spire small, of broad, rapidly increasing whorls. Suture deep, rather wide, facing horizontally. Whorls moderately convex, bending in rather suddenly at the suture. Ornament consisting of seven or more rows of elevated, rounded, spiral ridges, separated by slightly wider furrows, and divided into nodules by perpendicular lines crossing the whorls almost in a straight line from the suture. Mouth unseen in the English specimens.

Size.—Height about 10 mm., width about 11 mm.

Locality.—There are four specimens in the Battersby Collection, which appear to have come from Lummaton or Barton.

Remarks.—This is evidently a very beautiful and well-defined species. It has been well figured by *d'Archiac* and *de Verneuil*, by *Goldfuss* and by *Sandberger*, and their figures evidently agree, although the former authors represent the shell as a little more angulated or trochiform than do the latter. *Sandberger*,¹ however, figures as varieties two far more angulated and depressed shells than that of *d'Archiac*, so that his shell evidently includes *d'Archiac's*. They all give the mouth, which is rounded, has the umbilicus closed by a callosity, and bears a large blunt central or subcentral tooth on the inner lip. The columella is merged into the lips on both sides.

The English specimens in the Battersby Collection are all very defective, and would enable us to know very little about the species were it not that they evidently correspond with the German examples. They agree rather with *Sandberger's* than with *d'Archiac's* figure. The cancellation of the surface is, however, very clearly shown in them.

¹ 1853, *Sandberger*. 'Verst. Rhein. Nassau,' p. 222, pl. xxv, figs. 18, 19.

The species was named by Goldfuss without a description in von Dechen's 'Handbuch' in 1832; but in 1842 it was independently described by two other authors under two different names. It is a matter of some difficulty to determine which of these two latter has the priority; but from the facts stated below (p. 284) it appears most probable that it lies with d'Archiac and de Verneuil. Sandberger, in his later work, though asserting that his name has the priority, withdraws it in favour of d'Archiac's as being the more suitable.

Affinities.—*Scoliostrongylus texata*, Münster, sp., has a much higher spire and a much sharper, though somewhat similar, ornamentation. The shape of its mouth, moreover, shows it to be quite a different kind of shell, so that the similarity of its markings is only superficial.

The shape of the mouth resembles that of *Plagiothyra archon*, which differs in its surface being almost smooth.

Delphinula funata, Goldfuss,¹ from the Coralline Oolites, is very similar in ornament, but it is a shorter, more globular shell, with a totally different mouth and with an umbilicus.

Naticopsis Ciana, Vern., sp.,² is according to Barrois³ a more elongate form, with a larger body-whorl.

2. PLAGIOTHYRA ARCHON, *Whidborne*, sp. Pl. XXVI, figs. 6, 6 a, 7, 7 a, 7 b.

1889. MONODONTA ARCHON, *Whidborne*. Geol. Mag., dec. 3, pt. 6, p. 30.

Description.—Shell large, elevated, trochiform, consisting of few and quickly expanding whorls. Suture almost linear. Whorls nearly flat, spreading at once obliquely down from the suture, with a row of low indistinct nodules immediately below it, and then becoming first slightly concave, and then slightly convex until they suddenly curve to form the flat base of the shell, which is apparently without an umbilicus. Mouth entire, bluntly triangular, very oblique, so that the plane through it slopes backwards and downwards at an angle of more than 45°. Outer lip sharp. Inner lip diffuse and concave, spreading over a large part of the base of the shell, and bearing a single broad, low, flat tooth in its centre. Surface ornamented with a few, coarse, regular growth-lines, sloping obliquely backwards from the sutures. Shell-structure thick. Colour black(?).

Size.—Height 35 mm., width 45 mm., in a specimen in which the apical whorls are absent.

Locality.—Chudleigh. Three specimens in Mr. Vicary's Collection.

¹ 1844, Goldfuss, 'Petref. Germ.,' vol. iii, p. 89, pl. exci, fig. 11.

² 1846, Verneuil, 'Bull. Soc. Géol. Fr.,' ser. 2, vol. iii, p. 455.

³ 1882, Barrois, 'Mém. Soc. Géol. Nord,' vol. ii, No. 1, p. 346, pl. xvii, figs. 15 a, b.

Remarks.—This is evidently a very fine and remarkable species, but unfortunately in all the known specimens the upper part of the shell is too defective to enable its shape to be definitely made out. Its contour appears to have probably been obliquely conical, and scarcely indented by the sutures. The mouth, on the other hand, is very clearly shown, and is remarkable for its deeply excavate inner lip, its broad median tooth, its sharp bevelled outer margins, and its great obliquity, thus giving good generic characters.

2. *Genus.*—FLEMINGIA, *de Koninck*, 1881.

“Shell conical, with a sharp apex. Whorls numerous, nearly flat, angulated at the circumference. Mouth often compressed, angular behind; peristome not continuous. Lip oblique, thin, sharp. Columella thin, slightly twisted on itself, and forming an umbilical depression more or less large, but not perforated. Surface smooth, or simply covered with irregular oblique lines of growth, rarely spirally striated.”

De Koninck thus defines his genus, which seems on the whole to agree with *Trochella*, M'Coy. It extends from the Silurian to the Carboniferous.

The following species appears to belong to it, as far as can be judged from the state of the specimens observed.

1. FLEMINGIA PERVERSA, *Whidborne*, sp. Pl. XXVII, figs. 2—4.

1889. PLEUROTOMARIA PERVERSA, *Whidborne*. Geol. Mag., dec. 3, vol. vi, p. 30.

Description.—Shell large, sinistral, broadly conical, of five rather slowly increasing volutions. Apex sharp. Spire pagoda-shaped, formed by the revolution of a concave line, the slope of the upper whorls being much less than that of the body-whorl. Suture small, deep, simple, facing outwards. Whorls sloping out from the suture in a slightly convex curve to the widest and almost lowest part, where they turn suddenly and sharply through a right angle over a narrow, flat supersutural band, which is ornamented by three rows of small close tubercles, to form the flat oblique base. Ornament consisting of a slight cancellation formed by eight or ten very minute distant threads above the band (which is bounded by a more prominent ridge), crossed by very oblique lines which arch obliquely backwards. Mouth subcircular, transverse. Shell-structure rather thin.

Size.—A small specimen is 19 mm. high by 23 mm. wide. A large specimen is about 30 mm. high.

Locality.—Wolborough. There are two specimens in Mr. Vicary's Collection; two others in the Godwin-Austen Collection of the Museum of Practical Geology; and another, perhaps from the same place, in Mr. Champernowne's Collection.

Remarks.—These specimens are easily distinguished by their peculiar form. They are all sinistral, and the flatness of the whorls increases with the growth of the shell, so as to give a peculiar unsymmetrical appearance to the spire. The specimens in the Museum of Practical Geology are rather more elongate than the others, and their whorls are somewhat more convex, but they clearly belong to the same species.

The narrow band, which truncates the otherwise sharp keel of the back, has much the appearance of a sinus-band, and as such I was at first inclined to regard it. In this case it would of course belong to the genus *Pleurotomaria*. But in no instance does it show any signs of a flexion of the growth-lines, and I now think that in all probability it does not indicate a labial sinus. In some specimens I cannot detect this band, and it seems replaced by a simple rounded edge.

Affinities.—From *Trochus petræos*, Münster,¹ these fossils differ in size, in being sinistral, in having decidedly narrower whorls, and in having fewer (twelve instead of fifteen) spiral threads, and more prominent transverse threads, so that the surface is more definitely reticulate. *Trochus Neptuni*, Münster,² is another closely allied dextral shell, differing in being much more elevated, in having a beaded spiral ridge immediately below the suture, and in having fewer spiral threads. It is, however, reticulate like the English form, which thus comes midway between these two German shells, but is distinguished from both by being sinistral. The latter character is constant in the English specimens, and with the other differences is ample to constitute a specific distinction.

Sandberger regards Münster's *Trochus petræos* as belonging to a section of *Pleurotomaria* which he calls *Nodulosæ*, and defines as sinistral and granuliferous.

Pl. elegans, d'Arch. and de Vern.,³ which is figured by Goldfuss,⁴ and is the same as *Pl. nodulosa*, Sandberger,⁵ but not as *Pl. antitorquata*, Phillips (not Münster), approaches very near to this species, which is distinguished from it by its flatter, more pagoda-like shape, its reticulate rather than granular ornament, its size, its more angular whorls, and especially by the acute ridge or angle immediately above the band; these features bring it nearer to *Pl. exiliens*,⁶ which again differs in the perfect flatness of its whorls and its granular ornament. From these shells, however, the absence of a sinus-band seems definitely to separate it.

There is nothing which could at all represent it in Phillips's 'Pal. Foss.' Mr. Vicary's specimens were labelled by Salter "left-handed species, distinct from

¹ 1840, Münster, 'Beitr.,' pt. 3, p. 88, pl. xv, fig. 16.

² Ibid., p. 88, pl. xv, fig. 15.

³ 1842, d'Archiac and de Verneuil, 'Geol. Trans.,' ser. 2, vol. vi, pt. 2, p. 360, pl. xxxiii, figs. 3, 3a—c.

⁴ 1844, Goldfuss, 'Petref. Germ.,' vol. iii, p. 63, pl. clxxxii, fig. 10.

⁵ 1853, Sandberger, 'Verst. Rhein. Nassau,' p. 200, pl. xxiv, figs. 13, 13a—c; and 1842, G. Sandberger, in 'Neues Jahrb. f. Min.,' p. 390, pl. viii B, fig. 4.

⁶ 1853, Sandberger, 'Verst. Rhein. Nassau,' p. 200, pl. xxiv, figs. 12, 12a.

antitorquata ;” and in that he was clearly right, as both Münster’s¹ and Phillips’s² species totally differ from the present form in their elevation, in the rotundity of their whorls, and in the position of their sinus-band.

Pl. expansa, Phillips,³ differs, as described from Devonshire, in its flat whorls, its more depressed and definitely conical shape, its small suture, and the absence of spiral threads.

Trochus ellipticus, Hisinger,⁴ seems to be a higher form with straighter sides, and to have four or five distant indistinct spiral ridges on each whorl. Giebel⁵ states it to be the same as *Turbo antiquissimus*, Eichwald.⁶

Under the name of *Trochus oxygonus*, F. A. Römer⁷ describes a dextral shell which is very similar in general shape, but, as it is a cast, it is impossible to say whether its ornament agreed, and, moreover, it appears to have a much larger umbilicus.

Flemingia acies, F. A. Römer,⁸ sp., is a dextral and much more globose shell.

2. Sub-family.—UMBONINÆ, Adams.

1. Genus.—ROTELLINA, de Koninck, 1881.

This genus contains small flattish shells with long and highly enveloping spires, rounded whorls, and without any umbilicus. De Koninck formed it for a single species from the Carboniferous Formation of Belgium.

1. ROTELLINA ? HELICINA, Münster, sp. Pl. XXVI, figs. 10, 10 a, 11, 11 a.

1840. EUOMPHALUS HELICINUS, Münster. Beitr., pt. 3, p. 85, pl. xv, figs. 7 a, b.

Description.—Shell small, lenticular or subdiscoid, very depressed. Spire so low as to be almost flat, of four rapidly decreasing whorls. Suture scarcely indented. Whorls slightly rising and spreading flatly from the suture, and, when they have nearly reached their greatest width, curving round to form a

¹ 1840, Münster, ‘Beitr.’ pt. 3, p. 87, pl. xv, fig. 12 (*Schizostoma*).

² 1841, Phillips, ‘Pal. Foss.’ p. 96, pl. xxxvii, fig. 176 d.

³ 1841, Phillips, ‘Pal. Foss.’ p. 97, pl. xxxvii, fig. 179; and 1836, Phillips, ‘Geol. Yorks.’ pt. 2, p. 226, pl. xv, fig. 4.

⁴ 1844, Goldfuss, ‘Petref. Germ.’ vol. iii, p. 48, pl. clxxviii, figs. 4 a, b.

⁵ 1866, Giebel, ‘Repertorium,’ p. 97.

⁶ 1842, Eichwald, ‘Urwelt Russlands,’ vol. ii, p. 53, pl. ii, fig. 7.

⁷ 1843, F. A. Römer, ‘Verst. Harzgeb.’ p. 29, pl. viii, fig. 5.

⁸ 1850, F. A. Römer, ‘Beitr.’ pt. 1, p. 37, pl. v, figs. 25 a, b; and 1884, Clarke, ‘Neues Jahrb. f. Min.,’ Beil.-Band iii, p. 352.

moderately convex back with an axis parallel to the perpendicular of the spire. The upper whorls hidden almost up to the shoulder. Surface smooth.

Size.—Height 4 mm., width 9 mm.

Locality.—There is a specimen in the Woodwardian Museum which was collected by my friend the late Mr. E. B. Tawney from Lummaton, and another specimen in the Torquay Museum, apparently from the same locality.

Remarks.—This species is distinguishable by its almost flat spire, the very slight rising of the whorls from the suture, and the bluntly rounded or compressed appearance of the side of the whorls. Our specimens appear to correspond almost exactly with Münster's figure of his *Eu. helycinus*, and I have no doubt that it must be referred to that species. To what genus, however, it is to be referred is another question. I should certainly not regard it as a *Euomphalus*, but as the mouth and umbilicus are hidden in the English specimens its place is not easy to decide. As far as the evidence goes it probably best agrees with the characters of *Rotellina*, de Kon.

Affinities.—Münster distinguishes this shell from *Euomphalus subcarinatus*, Münster,¹ by the absence of any keel upon the back of the whorls. The same point and the much greater height and rotundity of its whorls separate it from *Pleurotomaria gracilis*, Phillips.²

Rotella helicinoformis, Goldfuss³ (= ? *Helicites helicinoæformis*, Schloth.⁴), is a much more globose and rapidly increasing shell. *Rotella Wurmi*, F. A. Römer,⁵ also appears decidedly more globose, though it closely resembles the present shell.

Platyschisma helix, Clarke,⁶ appears to be a wider shell with more transversely oval whorls.

Rotellina planorbiformis, de Koninck,⁷ has a rather longer and more slowly decreasing spire, and is not umbilicated.

3. *Sub-family*.—LIOTINÆ, Adams.

1. *Genus*.—LIOTIA, Gray, 1842.

The shells of this genus have few whorls, are subglobose, and strongly ribbed or nodulated. They have a continuous subcircular mouth, and a very

¹ 1840, Münster, 'Beitr.,' pt. 3, p. 85, pl. xv, fig. 5.

² 1841, Phillips, 'Pal. Foss.,' p. 98, pl. xxxvii, fig. 181.

³ 1844, Goldfuss, 'Petref. Germ.,' vol. iii, p. 102, pl. cxcv, figs. 7 a—c.

⁴ 1820, Schlotheim, 'Petrefact.,' p. 104, pl. xi, fig. 6.

⁵ 1843, F. A. Römer, 'Verst. Harzgeb.,' p. 30, pl. viii, figs. 6 a—c.

⁶ 1884, Clarke, 'Neues Jahrb. f. Min.,' Beil.-Band iii, p. 358, pl. iv, figs. 22—24.

⁷ 1881, de Koninck, 'Annales Musée Royal H. N. Belg.,' vol. vi, p. 92, pl. x, figs. 36—38.

massive shell-structure. The genus is described as beginning in the Trias, but the shell described below is so similar to some of the modern forms that both Mr. Edgar A. Smith and myself independently referred it to this genus. *Neritopsis*, Grat., is the only other genus which it approaches, but it differs from that in not having a reticulated surface.

1. *LIOTIA BREVIS*, *Sowerby*, sp. Pl. XXVI, figs. 8, 8 a, 9.

1827. *BUCCINUM BREVE*, *Sowerby*. Min. Conch., vol. vi, p. 128, pl. dlxvi, fig. 3.
 1841. *MACROCHEILUS BREVIS*, *Phillips*. Pal. Foss., p. 102, pl. xxxix, fig. 193.
 1849. — *PHILLIPSII*, *d'Orbigny*. Prodrôme, vol. i, p. 63.
 1849. *MURCHISONIA BREVIS*, *d'Orbigny*. Ibid., vol. i, p. 70.
 1854. *MACROCHEILUS BREVIS*, *Morris*. Catal. Brit. Foss., p. 256.
 ? 1889. *TURBO SCHWELMENSIS*, *Kayser*. Zeitschr. deutsch. geol. Gesell., p. 289,
 pl. xiii, figs. 1, 1 a, 1 b.

Description.—Shell large or small, massive, more or less depressed, turbinated, of few whorls. Spire of four rapidly increasing whorls. Suture deep, narrow, facing upwards, complicated by the ornament. Apex acute. Upper whorls obliquely flat, being more than half enveloped by the succeeding whorls. Body-whorl forming a wide oblique semi-ellipse. Ornament consisting of two or three spiral rows of large, sharp nodules, set on elevated rounded spiral bands, which are divided by more or less distinct shallow furrows; the nodules being also transversely arranged in rows, which slope slightly backwards from the suture, and, when worn, are seen to result from the lines of growth. Mouth large, subtriangular externally, subcircular internally, with sharpish, bevelled outer lip. Shell-structure very thick. Inner lip almost straight, swollen externally, so as to fill, but not to cover, the umbilicus. Upper extremity of mouth externally pointed. Base of shell ornamented with two or three low spiral ridges.

Size.—A perfect specimen in Mr. Vicary's Collection measures 18 mm. in height and 23 mm. in width. A specimen in the Torquay Museum measures 30 mm. in width. Most of the specimens, enumerated below, are much smaller.

Locality.—Chudleigh. There are twelve specimens in Mr. Vicary's Collection; four in the British Museum (labelled "Barton," but shown by their mineral condition to be evidently from Chudleigh); one in the Woodwardian Museum; a poor fragment of the spire in the Godwin-Austen Collection; and a very large specimen of the body-whorl in the Torquay Museum. The last specimen, though unlike most of the Chudleigh shells in mineral character, is so similar to the Woodwardian specimen that it evidently came from the same locality.

Remarks.—Most of the specimens of this beautiful and highly ornamented shell

are perfect and free from matrix, but still there is considerable difficulty in deciding both its generic and its specific position. A shell is described by Sowerby under the name *Buccinum breve*¹ from "Bradley." His drawing was taken from a very poor specimen, but evidently agrees with our shell and with *Macrocheilus brevis*, Phillips, which is also said to be from "Bradley, near Newton Bushell." That shell bears a certain resemblance to our specimens, but is still so different from most of them that, if Phillips's figure be accurate, it could only be classed with them on the supposition that the species is extremely variable. The species is certainly extremely variable, as may be seen by examining the specimens in the British Museum or in Mr. Vicary's Collection. These show great variations in height, so as almost to include Phillips's shell, which is much longer than is usual with them. That feature, however, may be partly due to distortion, from which many of these shells have evidently suffered.

The markings of this species are very peculiar. The upper whorls show them normally to be straight, raised, flattened, transverse ridges. As the shell advances in growth these are gradually broken into spiral rows by one or two furrows, and become short, curved, sharpish spines or nodules, which gradually seem to diminish and grow wider apart on the body-whorl.

Generically the shell bears some likeness to *Ampullina*, but is separated from it by having a highly ornamented surface and by other particulars.

It appears that the shell described by Kayser under the name of *Turbo Schwelmensis* belongs to the same species, although the German fossil is a much larger and finer specimen than are any of the English shells. Remembering the variability of the English species, it is far more probable that the differences observable between them have no specific weight.

Affinities.—*Delphinula subarmata*, Sandberger,² presents some similarity to the present species, but it differs in having much closer, smaller, and more regular nodules, a more angulated mouth, and an umbilicus; thus most probably it did not belong even to the same genus.

4. Sub-family.—TURBININÆ, Swainson, 1840.

1. Genus.—ELASMONEMA, Fischer, 1885.

The genus *Callonema* was formed by Hall³ in 1879 for elongate or subglobose shells with rather numerous convex whorls, which are ornamented by distant, sub-

¹ 1827, Sowerby, 'Min. Conch.,' vol. vi, p. 128, pl. dlxvi, fig. 3.

² 1853, Sandberger, 'Verst. Rhein. Nassau,' p. 215, pl. xxv, figs. 10, 10 a—c.

³ 1879, Hall, 'Pal. N. Y.,' vol. v, pt. 2, p. 50.

lamellar spiral striæ. The aperture is circular, the lips are continuous, and the umbilicus rather large. As the name *Callonema* had been used by Conrad in 1873, Fischer has substituted *Elasmonema* as the name for the genus. According to Fischer,¹ these shells have been regarded by Lindström and by Meek as belonging to the Scalaridæ. He himself twice describes the genus, placing it first under the name of *Elasmonema* under the Scalaridæ, and then under the name of *Callonema* near the Trochidæ. By Zittel² it is placed among the Trochidæ.

1. ELASMONEMA ROTUNDUM, n. sp. Pl. XXVII, fig. 5.

Description.—Shell of moderate size, elevated, turbiniform, turrited, of about four rather rapidly increasing whorls. Spire conical, about half the height of the shell, rather more slender apically than below owing to the expansion of the body-whorl. Suture very deep and rather acute. Whorls very much swollen, subquadrate or step-like, of equal width and height; in section spreading convexly out from the suture to the shoulder, then turning suddenly to the back, which is nearly flat, then again turning suddenly to the base, which is nearly flat, and then turning suddenly upwards to the umbilicus. Body-whorl comparatively larger and wider than the whorls of the spire. Ornament almost obliterated, but apparently consisting of very numerous, flat, parallel, close, spiral ridges divided by deep grooves. Umbilicus very large and deep, penetrating far up the centre of the shell. Mouth unseen. Shell-structure thin.

Size.—Height 20 mm., width 18 mm.

Locality.—Wolborough. A single specimen is in Mr. Vicary's Collection.

Remarks.—The specimen from which the above description is taken is almost entirely a cast, but a few small fragments of the shell remain which show that the shell-structure is very thin, and that the cast closely represents the form of the external shell. The striæ are visible to the naked eye, and were probably between twenty and thirty in number upon the body-whorl.

Affinities.—This species is distinguishable from *Callonema lichas*, Hall,³ by having a wider shell, more quadrate whorls, and a larger umbilicus.

¹ 1887, Fischer, 'Manuel Conch.,' pp. 778 and 836.

² 1882, Zittel, 'Handb. Pal.,' pt. 1, Band ii, p. 188.

³ 1879, Hall, 'Pal. N. Y.,' vol. v, pt. 2, p. 52, pl. xii, figs. 19—22.

2. *Genus*.—TURBO, *Klein*, 1753 ; *Linnaeus*, 1758.

The four following species are only represented by poor specimens. In general shape they agree with shells of this genus, but whether they really belong to it cannot be definitely decided until better specimens come to hand.

1. TURBO INAMICTUS, n. sp. Pl. XXVII, fig. 1.

Description.—Shell small, elevated, turbiniform. Spire conical, elevated, of four or five rapidly increasing whorls. Suture deep, horizontal, rectangular. Whorls rather broad, nearly evenly convex. Body-whorl large, dilated, more than half the height of the shell. Base convex. Mouth nearly circular, but pointed above. Inner lip much arched, diffuse, thickened. Outer lip dilate and convex. No umbilicus. Surface unknown.

Size.—Height 10 mm., width 7 mm.

Locality.—Wolborough. A single specimen is in the Torquay Museum.

Remarks.—Little can be said of the small fossil here described. Its surface is quite decayed, so that it is impossible to tell whether it was smooth or ornamented. In general shape it bears some resemblance to species described under the genus *Macrochilina*, but the character of the aperture seems to show that it does not belong to that group of fossils.

It might very well belong to the *Ptychomphalus* of Agassiz, a sub-genus of *Pleurotomaria*, if it proved to possess a sinus-band on the body-whorl ; but the defective surface of our specimen gives no testimony on this point.

I have not observed any foreign species to which it is likely to belong ; and therefore as it appears to be a distinct form I have suggested for it a provisional name.

2. TURBO PENGELLII, *Whidborne*. Pl. XVII, fig. 14, and Pl. XXVII, fig. 7.

1889. TURBO PENGELLII, *Whidborne*. Geol. Mag., dec. 3, vol. vi, p. 30.

Description.—Shell small, turritid, turbiniform. Spire step-shaped, of few whorls, probably four or five, rapidly decreasing. Suture well defined. Whorls spreading out almost horizontally and flatly from the suture for about one-third of their breadth, and then traversed by a low, blunt, spiral ridge or angle, after

which they become slightly convex and nearly parallel to the perpendicular through the apex. Base of shell convex. Mouth, ornamentation, columella, &c., unseen.

Size.—Height 14 mm., width 10 mm.

Locality.—There is a single worn specimen of this shell in the Battersby Collection in the Torquay Museum, which probably came from Barton or Lummaton; and another fragmentary specimen from Wolborough in Mr. Vicary's Collection.

Remarks.—The two specimens which I know of the present species are unfortunately very defective, and hence its position can only be determined by comparison with Continental forms. It is, however, so similar to the shell described as *Turbo subangulosus*, F. A. Römer,¹ as evidently to belong to the same genus as that shell, though separated from it by specific differences. Mr. Roberts and I concluded that it was distinguished from it by being more angulated in form, by having the part of the whorl above the shoulder more flattened, and by having the ridge upon the shoulder much further from the suture than in that shell.

3. TURBO CIRRIFORMIS, Sowerby. Pl. XXVII, fig. 6.

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| 1840. | TURBO CIRRIFORMIS, Sowerby. | Geol. Trans., ser. 2, vol. v, pt. 3, pl. lvii,
figs. 19, 20. |
| 1848. | — — | d'Orbigny. Prodrome, vol. i, p. 67. |
| 1854. | — — | Morris. Catal. Brit. Foss., p. 282. |
| 1888. | — — | Etheridge. Foss. Brit., vol. i, Pl., p. 165. |

Description.—"Conical, short, oblique, smooth; apex obtuse; whorls slightly rounded, most prominent below; aperture circular. Height and diameter equal, about half an inch" (Sowerby).

Localities.—"Common at Stonehouse Hill." There is one specimen of this species in Mr. Vicary's Collection from Chudleigh.

Remarks.—Mr. Vicary's specimen is a mould, and shows nothing of the shell except that it was massive. It agrees, however, as far as it goes, so accurately with Sowerby's figure and description that there is every reason to believe that it belongs to the same species, especially as I know of no other shell from these localities of which it could be the cast.

¹ 1843, F. A. Römer, 'Verst. Harzgeb.,' p. 29, pl. viii, fig. 8.

4. *TURBO NEGLECTUS*, *Phillips*? sp. Pl. XXVII, fig. 8.

1840. *TURBO SUBANGULATUS*, *Sowerby* (not *Brocchi*). Geol. Trans., ser. 2, vol. v, pt. 3, pl. lvii, fig. 18.
- ? 1841. *MACROCHEILUS*? *NEGLECTUS*, *Phillips*. Pal. Foss., p. 105, pl. xxxix, figs. 196 a, b.
1849. *LOXONEMA NEGLECTUS*, *d'Orbigny*. Prodrome, vol. i, p. 63.
1849. *TURBO NISO*, *d'Orbigny*. Prodrome, vol. i, p. 67.
- ? 1854. *MACROCHEILUS*? *NEGLECTUS*, *Morris*, Catal. Brit. Foss., p. 256.
1854. *TURBO SUBANGULATUS*, *Morris*, Catal. Brit. Foss., p. 283.
1888. — — *Etheridge*. Foss. Brit., vol. i, Pal., p. 165.
1888. *MACROCHEILUS NEGLECTUS*, *Etheridge*. Foss. Brit., vol. i, Pal., p. 164.

Description.—Shell small, rather elevated, trochiform, slightly turrited. Spire consisting of about four rather narrow whorls. Suture excavated, deep, and rather broad, crenulated by the ornament. Whorls spreading out obliquely for a short distance from the suture, and then becoming flat and conical till they bend in a little at the lower suture. Ornament on the upper whorls consisting of broad, flat, rather oblique, straight, transverse ridges, which are divided by similar furrows, and which in the lower whorls become broken by spiral furrows into four rows of rather confluent, large, elevated, blunt mammillæ or tubercles, of which the first and third rows are smaller and lower than the second and fourth. Body-whorl slightly rounding-in below. Base and mouth not seen. Shell-structure rather thick.

Size.—Height about 14 mm., width about 11 mm.

Locality.—There are three specimens in the Torquay Museum, two of which are in the Battersby Collection. They probably came from Lummaton or Barton.

Remarks.—Sowerby describes under the name of *Turbo subangulatus* an obscure water-worn shell which differs from our specimens in having only three spiral ridges, and, judging from his figure, in being rather more elongate. He does not state whether the spiral ridges are tuberculated; and, indeed, his specimen is so poor that probably all trace of tubercles, as well as of the fourth ridge, may have been worn away. It is, therefore, most probable that these Torquay shells belong to his species; although from its description it is quite impossible to speak with any degree of certainty one way or the other. I have been unable to meet with the type specimen.

This shell is not to be confounded with *Turbo subangulosus*, F. A. Römer,¹ which is a totally different form.

Phillips gives the name of *Macrocheilus*? *neglectus* to an unidentifiable fragment from Brushford, but appends to it Sowerby's description of the present shell.

¹ 1843, F. A. Römer, 'Verst. Harzgeb.', p. 29, pl. viii, fig. 8.

His figure does not look at all like our specimens, but it is only a cast, and is evidently imperfect or distorted. Hence there is some difficulty in fixing upon the right name for our fossils.

D'Orbigny points out that Brocchi¹ had already used the name *Turbo subangulatus* for a Tertiary fossil, and calls it *T. niso*; but if Phillips's shell is the same as Sowerby's, his name would take precedence to D'Orbigny's.

IX. *Family*.—PLEUROTOMARIIDÆ, D'Orbigny, 1842.

1. *Genus*.—PLEUROTOMARIA, DeFrance, 1826.

This large and well-known genus, starting in the Silurian, is found in almost every succeeding form to the present time. In the Palæozoic and Mesozoic periods it abounded and is represented by many hundred species. In the Tertiaries it was rare and there are only four living species.

Our Devonian species show much variability of shape, and belong to several of the different sections into which de Koninck and others have subdivided the genus.

1. PLEUROTOMARIA CHAMPERNOWNI, n. sp. Pl. XXVI, figs. 1—5.

1889. TROCHUS MULTISPIRA? *Whidborne* (not *Sandberger*). Geol. Mag., dec. 3, vol. vi, p. 30.

Description.—Shell rather large, spiral, turrated, trochiform, of six or seven narrow and very slowly increasing volutions. Apex probably blunt. Spire conical or hive-shaped. Sutures very deep, acute, and vertical. Sutural angle very small and regular. Whorls very narrow; in section subquadrate, horizontal above and below, with slightly convex and nearly perpendicular back. Sinus-band central, broad, elevated, and slightly concave, containing a fine thread-like central line, and having the flexions of the transverse lines in it shallow. Surface above the sinus-band bearing two or three round, low, massive, spiral ridges, separated by similar grooves. Surface below the sinus-band first forming a small groove, and then curving round the lower and widest part of the shell to form the broad, flat, smooth, and nearly horizontal base. Growth-lines and secondary spiral markings very fine and indeed microscopic. Mouth very wide, subquadrate. Inner lip straight, slightly thickened, vertically twisted or corkscrew-like, so that it is slightly excavate at the lower corner of the mouth. Umbilicus, if any, very minute.

¹ 1814, Brocchi, 'Conchiologia Foss. Subapennina,' vol. ii, p. 374, pl. vi, fig. 16.

Size.—Height 20 mm., width 17 mm.

Localities.—From Wolborough there are three specimens in Mr. Vicary's Collection, and three in the Museum of Practical Geology. There are two in the Battersby Collection in the Torquay Museum, one of which, an extremely poor, almost unrecognisable specimen of the most elevated variety, is from Wolborough, and the other, equally poor, is apparently from Lummaton.

Remarks.—These specimens vary so much in the height of their spire and style of ornamentation that at first I was much disposed to regard them as belonging to more than one species. The latter quality is, however, probably due to their state of preservation. A specimen of Mr. Vicary's is the only one which retains the external shell, and therefore the only one whose ornamentation can be relied on. The decortication of the other specimens has more or less destroyed their true ornamentation.

In the above-named specimen the sinus-band is clearly shown, and hence it is clear that the species belongs to the genus *Pleurotomaria*.

Affinities.—From *Trochus multispira*, Sandberger,¹ which it resembles in the number of its whorls, it differs in the possession of spiral ridges, in the shape of the front of its mouth, and in the possession of a sinus-band.

2. PLEUROTOMARIA SUBCLATHRATA, Sandberger. Pl. XXVII, figs. 9—11.

1842. PLEUROTOMARIA SUBCLATHRATA, Sandberger. In Neues Jahrbuch f. Min.,
p. 391, pl. 8 B, fig. 5a—c.
1853. — — — Sandberger. Verst. Rhein. Nassau, p. 198,
pl. xxiv, figs. 10, 10 a—c.
1857. TURBO NANUS, Eichwald. Bull. Soc. Nat. Moscow, p. 164.
1860. — — — Lethæa Rossica, p. 1138, pl. xlv, fig. 20.
1889. PLEUROTOMARIA SUBCLATHRATA, Whidborne. Geol. Mag., dec. 3, vol. vi,
p. 30.

Description.—Shell of moderate size, turbate, turrit, rather depressed, of about four volutions. Spire conical. Suture rectangular. Whorls narrow, slowly increasing, spreading somewhat flatly from the suture to the shoulder, then suddenly turning and becoming perpendicular for about an equal distance, and then curving rapidly inwards to form an obliquely flat base. Sinus-band situated on the shoulder, narrow, very concave, bounded by steep, sharp, prominent ridges. Ornament consisting of one similar spiral ridge near the suture, two or three similar equidistant ridges on the back below the sinus-band, and smaller decreasing and rather closer ridges on the base. Mouth sub-quadrate, transverse? Inner lip arched. Umbilicus very small.

¹ 1853, Sandberger, 'Verst. Rhein. Nassau,' p. 218, pl. xxv, figs. 11, 11 a—c.

Size.—Height 17 mm., width about 18 mm.

Localities.—There are three rather poor specimens in Mr. Vicary's Collection, and two small indistinct specimens in the Museum of Practical Geology, from Wolborough. In the Bristol Museum is a small specimen from Lummaton.

Remarks.—These specimens are all imperfect, and are so much weathered that no finer ornamentation can be seen. Hence they do not in themselves show any distinctive marks of the genus *Pleurotomaria*. However, they so closely resemble *Pl. subclathrata* as described and figured by Sandberger, that Mr. Roberts and I came to the conclusion that they must be regarded as undoubtedly belonging to that species, the only difference being that the English shells are rather more coarsely ornamented than are Sandberger's types. On the other hand, they are so similar to various species of the genus *Cyclonema* of Hall¹ that it would be necessary to refer them to it, were it not that the fine ornamentation shown in Sandberger's figure proves that his shell is certainly a species of *Pleurotomaria*.

Turbo nanus, Eichwald, is either the young of this species or of *Trochus Ivanii*, Lév. It seems somewhat more elongate than the former, but exactly agrees with it in ornament, and I am therefore disposed to regard it as identical.

Affinities.—*Trochus Yvanii*, Lèveillé,² as shown by the original figure, is more elongate, and has finer, more numerous, and equal spiral lines. It appears to have an umbilicus, and is certainly distinct from the present species. It is a Carboniferous shell. As figured by Goldfuss,³ it is a more globose shell, with many more spiral ridges, than the English species. Again, as given by de Koninck from the Carboniferous of Belgium, under the name *Pleurotomaria Yvanii*, Lév.,⁴ it is sometimes as little elevated, but seems to differ in having all the ridges equal and similar, except those of the base, which are closer. In de Koninck's later work, where he calls it *Baylea Ivanii*, Lév.,⁵ it exactly corresponds with Lèveillé's original type.

None of the other species which de Koninck refers to his genus *Baylea*, which seems synonymous with Hall's *Cyclonema*, approach our English shell more nearly.

D'Archiac and de Verneuil give a Devonian variety of *Trochus Ivanii*,⁶ which

¹ 1879, Hall, 'Pal. N. Y.,' vol. v, pt. 2, p. 34.

² 1835, Lèveillé, 'Mém. Soc. Géol. Fr.,' vol. ii, p. 39, pl. ii, fig. 24.

³ 1844, Goldfuss, 'Petref. Germ.,' vol. iii, p. 51, pl. clxxviii, fig. 9.

⁴ 1842-4, de Koninck, 'Desc. Anim. Foss.,' p. 390, pl. xxxvii, figs. 1 *a-c* and 7 *a-c*.

⁵ 1883, de Koninck, 'Ann. Mus. Roy. H. N. Belg.,' vol. viii, pt. 4, p. 69, pl. xxvii, figs. 1-5, and pl. xxxii bis, figs. 8, 9.

⁶ 1842, d'Archiac and de Verneuil, 'Geol. Trans.,' ser. 2, vol. vi, pt. 2, p. 359, pl. xxxii, fig. 16.

comes very close, but is much less turrited, and has finer and more numerous ridges. This shell d'Orbigny separates under the name *Trochus devonicus*.¹

Turbo ellipticus, Münster,² also approaches it very closely, but is less turrited, and has more rounded and numerous ridges and a smaller spire.

Sandberger and Giebel³ identify the present shell with *Pl. catenulata*, d'Archiac and de Verneuil,⁴ but it differs from that species by having a more angulated and less conical spire, and its ridges are less distinctly granulated; and therefore it cannot be regarded as identical, although possibly allied. *Pl. catenulata*, as given by Goldfuss,⁵ is still more clearly shown to be distinct by the possession of a series of three close-set spiral rows of rounded nodules immediately below the suture.

Turbo micros, Trenkner,⁶ is similar in general shape, but is a more elevated shell.

Cyclonema Hamiltoniæ, Hall,⁷ is also very similar, but is rather more elevated, and has no marks upon the flat band between the suture and the keel on the shoulder. It has, of course, no sinus-band.

F. A. Römer⁸ describes a very similar shell, to which in his letterpress he gives the name "*Pleurotomaria scalaris*, Sandberger?" but in his plates *Turbo tricinctus*. His description is very slight, but, judging from his figure, it appears to be a more elevated species, with fewer, coarser, and more equal ridges. In a later part⁹ of his work he gives under the latter name a better figure and description, which show that it is very distinct, the ridges being coarsely nodular.

3. PLEUROTOMARIA LONSDALII, *D'Archiac* and *de Verneuil*. Pl. XXVII, fig. 12.

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| 1842. | PLEUROTOMARIA LONSDALII, <i>d'Archiac</i> and <i>de Verneuil</i> . | Geol. Trans., ser. 2, vol. vi, pt. 2, p. 359, pl. xxxii, figs. 21, 21 a. |
| 1844. | — — | <i>Goldfuss</i> . Petref. Germ., vol. iii, p. 63, pl. clxxxii, fig. 9. |
| 1853. | — EURYOMPHALUS, <i>Sandberger</i> . | Verst. Rhein. Nassau, p. 199, pl. xxiv, figs. 11, 11 a—d. |

¹ 1849, d'Orbigny, 'Prodrome,' vol. i, p. 64.

² 1844, Goldfuss, 'Petref. Germ.,' vol. iii, p. 91, pl. xcii, figs. 10 a, b.

³ 1866, Giebel, 'Repertorium,' p. 99.

⁴ 1842, d'Archiac and de Verneuil, 'Geol. Trans.,' ser. 2, vol. vi, pt. 2, p. 359, pl. xxxii, fig. 17.

⁵ 1844, Goldfuss, 'Petref. Germ.,' vol. iii, p. 63, pl. clxxxii, fig. 11.

⁶ 1867, Trenkner, 'Paläont. Novit.,' pt. 1, p. 8, pl. i, fig. 14.

⁷ 1879, Hall, 'Pal. N. Y.,' vol. v, pt. 2, p. 37, pl. xii, figs. 34—36.

⁸ 1850, F. A. Römer, 'Beitr.,' pt. 1, p. 15, pl. iii, figs. 14 a, b.

⁹ 1855, *ibid.*, pt. 3, p. 14, pl. iii, figs. 19 a, b.

1866. PLEUROTOMARIA LONSDALII, *Giebel*. Repertorium, p. 99.

1889. — — — — — *Whidborne*. Geol. Mag., dec. 3, vol. vi, p. 30.

Description.—Shell rather small, flatly conical, of four or five rapidly increasing volutions. Spire of the form of a low convex cone. Suture deep, small, rectangular. Whorls narrow, curving immediately at the suture, then sloping obliquely and flatly to the lowest and widest part, and there curving rapidly inwards to form a broad, flat, and almost horizontal base. Umbilicus rather large, shallow. Mouth unseen. Surface above the sinus-band covered by about nine small, low, close, crenulated, spiral striæ. Sinus-band apparently convex and slightly truncating the curve at the widest or supersutural part, but very indistinctly seen.

Size.—Height 13 mm., width 18 mm.

Locality.—Wolborough. A single specimen is in the Museum of Practical Geology.

Remarks.—The only specimen I have seen is in a very poor state of preservation, and its ornamentation can only be approximately traced. As far as can be judged it appears to be referable to the shell described by d'Archiac and de Verneuil, although its spiral striæ seem to have been considerably more numerous. These authors state the spiral striæ on the back of the whorls to have been only four, with, however, some smaller intermediate ridges. In their figure, however, as well as in that given by Goldfuss, about six are shown, while in *Pl. euryomphalus*, which Sandberger himself identifies with *Pl. Lonsdalii*, nine are drawn, and they are described as "numerous." As our specimen is rather larger than d'Archiac and de Verneuil's figure it is possible that this may in part account for the difference. On the whole there seems no reason to doubt its identity.

Affinities.—*Pl. Beaumontii* d'Archiac and de Verneuil¹ has a higher spire, more convex whorls and a more distinct cancellation.

Trochus Klippsteinii Goldfuss² is not very dissimilar from it in general shape, but is a much flatter shell, with more evenly convex whorls and a more rounded base. Its ornamentation appears different.

In *Pl. fragilis* de Koninck³ from the Carboniferous, which is very closely allied, the ornament seems more distant, the spire less conical, and the whorls more evenly convex.

¹ 1842, d'Archiac and de Verneuil, 'Geol. Trans.,' ser. 2, vol. vi, pt. 2, p. 361, pl. xxxiii, figs. 1, 1 a.

² 1844, Goldfuss, 'Petref. Germ.,' vol. iii, p. 50, pl. clxxxi, fig. 1.

³ 1842-4, de Koninck, 'Desc. Anim. Foss.,' p. 372, pl. xxxv, figs. 8 a-c.

4. PLEUROTOMARIA IMPENDENS, *Sowerby*. Pl. XXVII, figs. 13, 13 a.

1840.	PLEUROTOMARIA IMPENDENS, <i>Sowerby</i> .	Geol. Trans., ser. 2, vol. v, pt. 3, pl. lvii, fig. 16.
? 1841.	— — —	<i>Phillips</i> . Pal. Foss., p. 98, pl. xxxvii, figs. 180, 180*.
1854.	— — —	<i>Morris</i> . Catal. Brit. Foss., p. 273.
? 1861.	— — —	HEBE, <i>Hall</i> ., Rep. N. Y. State Cab. Nat. Hist., p. 105.
? 1862.	— — —	Fifteenth Rep. N. Y. State Cab. Nat. Hist., pl. v, figs. 7 and 8.
? 1876.	— — —	Illust. Dev. Fos., pl. xix, figs. 2—7.
? 1879.	— — —	Pal. N. Y., vol. v, pt. 2, p. 68, pl. xix, figs. 2—7.

Description.—Shell of moderate size, turbiniform. Spire forming a low convex cone of about four slowly increasing volutions. Apex obtuse. Suture rather shallow and obtuse. Whorls semi-elliptic, sloping out obliquely and very convexly to their widest part, where they become perpendicular for a short distance above the lower suture. Body-whorl large, curving rapidly round the back, and becoming obliquely convex on the base. Sinus-band super-sutural, broad, consisting of three prominent close rounded ridges, divided by two narrow grooves. Ornament consisting of about ten close, low, rounded ridges above the sinus-band, crossed by numerous, close, flatly-rounded threads, which arch obliquely backwards on the upper part of the whorls, and become almost invisible, on the sinus-band, where they appear to be recurved. Umbilicus small or absent. Mouth unseen.

Size.—Height 18 mm., width 22 mm.

Localities.—There is a specimen in Mr. Champenowne's Collection from Lummaton, and a cast in Mr. Vicary's Collection from Wolborough.

Remarks.—This appears to be the shell imperfectly described by Sowerby from Plymouth, though his figure and description are not clear enough to permit any very great certainty. Our specimens are obscured round the base, which seems on the whole convex, though there may have been a concavity round the umbilicus. Sowerby speaks of the base as concave; but in other respects his description appears to agree with the present fossils.

The ornament of the shell appears to be very distinct. The spiral marks dominate, and the narrow furrows between the close ridges quite cut the longitudinal threads. As the lower part of the body-whorl and the base of Mr. Champenowne's specimen are decayed, the ornament on that part of the shell is unknown.

Affinities.—It comes very near *Pl. Beaumonti*, d'Arch. and de Verneuil¹ in general shape, but differs from it in its much greater size, its more convex spire, and the closeness of its ridges. Goldfuss's figure of that species² also shows that the sinus-band was of different character, being a simple concave band marked by fine arching striæ. Sandberger identifies *Pl. Beaumonti* with his *Pl. decussata* var. *elegans*,³ which differs from the present shell in the same particulars, and is clearly distinct.

Pl. elegans, d'Arch. and de Verneuil,⁴ more nearly approaches it in ornament, but is much more elevated, and appears to belong to a distinct group of sinistral shells.

Pl. gemmulifera, Phillips,⁵ as given by de Koninck,⁶ is less turritid, and has broader furrows, minute and definite granules, and a better defined sinus-band.

Pl. granulata, de Koninck,⁷ is also rather similar, but is considerably more elevated, and has a convex granulated sinus-band.

Pl. Hebe, Hall, appears so close to the present shell that neither from Hall's figures nor rather short description can I see any sufficient reason for separating it. Neither the English nor the American specimens are very well preserved, and it is possible that with better specimens points of specific divergency might be brought to light. At present the only striking point in the American form is the great angularity of the body-whorl at the sinus-band, but this character vanishes in some of his specimens.

5. PLEUROTOMARIA ORBIGNIANA, *D'Archiac* and *de Verneuil*. Pl. XXVII, fig. 14.

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| 1842. | PLEUROTOMARIA ORBIGNIANA, | <i>d'Archiac</i> and <i>de Verneuil</i> . Geol. Trans., ser. 2, vol. vi, pt. 2, p. 359, pl. xxxii, figs. 18—20. |
| ? 1842. | — | BEAUMONTI. Ibid., p. 361, pl. xxxiii, fig. 1, 1 a. |
| 1842. | — | ORBIGNIANA, <i>d'Archiac</i> and <i>de Verneuil</i> . Bull. Soc. Géol. Fr., vol. xiii, p. 261. |
| 1842. | — | DECUSSATA, <i>Sandberger</i> . In Neues Jahrbuch f. Min., p. 392, pl. viiiB, figs. 6 a—c. |

¹ 1842, d'Archiac and de Verneuil, 'Geol. Trans.,' ser. 2, vol. vi, pt. 2, p. 361, pl. xxxiii, figs. 1, 1 a.

² 1843, Goldfuss, 'Petref. Germ.,' vol. iii, p. 62, pl. clxxxii, fig. 8.

³ 1853, Sandberger, 'Verst. Rhein. Nassau,' p. 197, pl. xxiv, figs. 3, 3 a—d.

⁴ 1842, d'Archiac and de Verneuil, 'Geol. Trans.,' ser. 2, vol. vi, pt. 2, p. 360, pl. xxxiii, figs. 3, 3 a—c.

⁵ 1836, Phillips, 'Geol. Yorks.,' pt. 2, p. 227, pl. xv, fig. 19.

⁶ 1842—4, de Koninck, 'Desc. Anim. Foss.,' p. 370, pl. xxxi, figs. 7 a—d.

⁷ Ibid., p. 373, pl. xxxiii, figs. 3 a—c.

- ? 1844. PLEUROTOMARIA BEAUMONTI. *Goldfuss*. Petref. Germ., vol. iii, p. 62,
pl. clxxxii, fig. 8.
- ORBIGNYANA. Ibid., p. 65, pl. clxxxiii, fig. 3.
1853. — DECUSSATA, *Sandberger* (pars). Verst. Rhein. Nassau,
p. 196, pl. xxiv, figs. 1, 1 a, 1 b.
1853. — DECUSSATA, var. ELEGANS, *Sandberger*. Ibid., p. 196,
pl. xxiv, figs. 3, 3 a—d.
1853. — DECUSSATA, var. GEMINATA, *Sandberger*. Ibid., p. 196,
pl. xxiv, figs. 9, 9 a.
1885. — ORBIGNYANA, *Maurer*. Kalke von Waldgirmes, Darm-
stadt, p. 234, pl. x, fig. 3.
1889. TURBO cf. ORBIGNYANUS, *Barrois*. Faun. Calc. d'Ebray, p. 216, pl. xv,
figs. 7, a, b.
1889. PLEUROTOMARIA D'ORBIGNIANA, *Whidborne*. Geol. Mag., dec. 3, vol. vi,
p. 30.

Description.—Shell very small, turbiniform, dilate, few-whorled. Spire conical, rather elevated, of three or four rather broad convex whorls. Suture deep, obtuse. Whorls horizontal at the suture, but immediately sloping obliquely downwards in a convex curve to the lower part, and there curving more rapidly inwards to the lower suture, or, in the case of the body-whorl, to form an obliquely flattish base. Sinus-band low down, being immediately above the suture in the upper whorls, and just below the widest point of the shell in the body-whorl, not elevated, broad, with low bounding ridges. Ornament consisting normally of eight distant spiral threads, similar to the ridges, above the sinus-band, and eleven below it, which are occasionally alternating or undeveloped; the upper part of the shell being thus divided into about five shallow grooves similar to the sinus-band, and the lower part into eight or nine which are closer; the whole crossed by more, and generally much more, numerous stout rounded threads, which slope obliquely back from the suture at an increasing angle till they reach the sinus-band, in which they curve round, and then proceed perpendicularly across the next groove, then tend rather backwards, and then again become perpendicular at the centre of the base. Umbilicus minute, aciculate, twisted. Inner lip not diffuse, and not continued to the upper angle. Columella longitudinally grooved, slightly arcuate. Mouth transversely ovate. Shell-structure rather thick.

Size.—Height 10 mm, width 10 mm.

Localities.—There are seven specimens in the Woodwardian Museum which were obtained by Mr. E. B. Tawney from Lummaton, and four in the Torquay Museum, which probably came from Lummaton and Wolborough.

Remarks.—There seems some doubt whether Sandberger's or d'Archiac and de Verneuil's name for these shells should have the priority. They were both published in the year 1842. Sandberger in his later work gives it to his own name; but it is to be noted that d'Archiac's paper was read in December, 1841,

and that in February, 1842, Sir R. Murchison, in his presidential address to the Geological Society, mentions it as soon to be published, whereas there is internal evidence in the 'Neues Jahrbuch' showing that Sandberger's paper was certainly not published till after April 10th, and probably much later in the year. It seems, therefore, best to follow Goldfuss, who first united them, and writing only two years afterwards gave the precedence to d'Archiac and de Verneuil. There is, I think, no doubt that both the shells described by these authors are of the same species.

Whether *Pl. Beaumonti*, d'Archiac and de Verneuil, is, as Sandberger supposes, a variety of the same shell is more doubtful. Its figure, at first sight, seems to suggest an ornament of close threads as in Mr. Champernowne's specimen of *Pl. impendens*, Sowerby, with which I at first identified it. On closer comparison, however, of the figure and description I am disposed to think that this appearance is misleading, and that really the ornamentation is much the same as in Sandberger's *Pl. decussata*; and moreover, while our figured specimen clearly belongs to that species, it presents decided approximation to *Pl. Beaumonti*, especially in the shape of the columella and the mouth. I am, therefore, now disposed to follow Sandberger in uniting it with this species. If this is so, Mr. Champernowne's fossil shows that *Pl. Beaumonti* cannot be a synonym of *Pl. impendens*, as that is quite different from the present form, being a much larger shell, and having many more spiral threads which are closely arranged instead of being separated by broad furrows.

We may note that in our figured specimen the transverse threads are very well marked, being rounded and raised so as to be almost unbroken by the intersecting spiral furrows, and about their own distance apart. On the whole they are twice as close as the spiral threads except where smaller intermediate spiral lines exist; but in another Torquay example they are hardly more numerous than the spiral threads.

Affinities.—In ornamentation and shape this species closely resembles *Euomphalus granulatus*, Münster,¹ but as that author refers his species to *Euomphalus* we must suppose that it had a large open umbilicus, and therefore was quite distinct from the present form. It is a decidedly lower shell than our specimens, and Münster's description leaves no room, if at all accurate, for any sinus-band.

Pl. cancellata, Phillips,² is very slightly described from South Petherwyn and Newton. Two imperfect specimens are figured; one of which is evidently from Wolborough, and is a very much larger shell with more rapidly increasing whorls and much less oblique reticulations, and clearly is different. The second figure, on the other hand, is about the same in general form, but the sinus-band is

¹ 1840, Münster, 'Beitr.,' pt. 3, p. 86, pl. xv, figs. 19 a, b.

² 1841, Phillips, 'Pal. Foss.,' p. 96, pl. xxxvii, figs. 176 a—c, f.

higher on the whorls, the spire seems more elevated, and the enlarged figure of the pattern is very different.

Turbo cf. *Orbigyanus*, Barrois, shows no sinus-band, but the specimen described being very poor it is very possible that it may be the same.

6. *PLEUROTOMARIA NEAPOLITANA*, n. sp. Pl. XXVII, figs. 15, 16.

Description.—Shell rather small, elevated, trochiform. Spire conical, apparently slightly produced apically, of four or five rather narrow whorls. Suture rather deep, but obscured and complicated by the ornament. Whorls spreading out obliquely and flatly from the suture to their lower extremity, where they turn through a short blunt angle for a short distance to the lower suture. Ornament consisting, upon the angle, of three sharp spiral carinæ, which are separated by furrows, and of which the central is the highest, and, upon the upper flattened part of the whorls, of five much less prominent spiral threads, which are crossed and reticulated or knotted by very numerous similar straight transverse threads sloping slightly backwards from the suture. Sinus-band probably situated between the two lower carinæ. Base of the shell flat, and ornamented by numerous fine spiral lineations. Mouth and umbilicus unseen.

Size.—Height about 18 mm., width about 16 mm.

Locality.—There are two specimens in the Torquay Museum which probably came from Lummaton or Barton. Another large but rather indistinct specimen in the Museum of Practical Geology is from Wolborough.

Remarks.—These specimens are all so much worn that it is difficult to feel certain about the direction of the finer lines, and the markings of the sinus-band are almost obscured. It is indeed very hard to say which of the two furrows between the large carinæ is the sinus-band, for the upper and widest is obscured by matrix, and in the lower of the two the cross striæ seem much finer, and have changed their direction, being either arched or sloping forward. The shell is remarkable for its extreme trochiform shape, reminding us strongly of the recent *Trochus ziziphinus*, but after a very careful examination of the markings I see no reason to doubt that it is really a *Pleurotomaria*.

Mr. Roberts was inclined to regard these specimens as large examples of *Pl. trochoides*, but it appears to me that they are distinguishable from that species by several particulars.

Affinities.—This species differs much from *Pl. angulata*, Sandberger,¹ in shape, ornamentation, and the position of the sinus-band, and especially in having an almost flat base instead of being convex below.

¹ 1853, Sandberger, 'Verst. Rhein. Nassau,' p. 204, pl. xxiv, fig. 19.

Trochus Bouei, Steininger,¹ is figured from an Eifel shell without description, and is hardly identifiable. It has almost the shape of an equilateral triangle, with one row of large separate tubercles on each of the upper whorls, and about six rows on the body-whorl. At all events it differs from the present shell in being strongly tuberculate.

I have employed the classic form of the word "Newton" for the name of this species.

7. PLEUROTOMARIA TROCHOIDES, *Whidborne*. Pl. XXVII, figs. 17—19.

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| 1841. | PLEUROTOMARIA MONILIFERA, | <i>Phillips</i> . | Pal. Foss., p. 97, pl. xxxvii, fig. 178 (not Geol. Yorks.). |
| 1842. | — | — | <i>d'Arch. and de Vern.</i> , Geol. Trans., ser. 2, vol. vi, pt. 2, p. 389. |
| 1854. | — | — | <i>Morris</i> , Catal. Brit. Foss., p. 273. |
| 1888. | — | — | <i>Etheridge</i> . Foss. Brit., vol. i, Pal., p. 164. |
| 1889. | — | TROCHOIDES, <i>Whidborne</i> . | Geol. Mag., dec. 3, vol. vi, p. 30. |

Description.—Shell small, trochiform, acuminate, of six or eight narrow volutions. Apex very small and slightly rounded. Spire conical, elevated, with slightly concave sides caused by the greater dilation of the lower whorls; sometimes a little bent on one side. Suture very deep, excavate, and rounded. Whorls spreading out obliquely and straightly to the elbow, which is nearly at the bottom of the whorl, and then turning through a sharp angle to form a flattish oblique base. Ornament generally coarse, consisting of two beaded spiral ridges immediately below the suture, followed by a wide, flat, or slightly concave median area or groove, which is smooth or filled with fine threads, then by a broad elevated sinus-band on the widest part, then by another groove bounded by a flat ridge, and then by numerous finer close ridges on the base; the surface being thus divided into two prominences and two grooves. Transverse ornament consisting of strong ribs, which cross and tuberculate the upper ridges in a forward direction, then, becoming much finer, sweep back across the median groove, then become perpendicular and sometimes very strong in the sinus-band, then tend forward in the groove below it, and then form a sigmoid curve on the base. Sinus-band bounded by two very strong prominent ridges. Mouth apparently trapezoidal, produced in front. Columella thick, arched. Shell-structure thick. No umbilicus.

¹ 1834, Steininger, 'Mém. Soc. Géol. Fr.,' vol. i, pt. 2, p. 371, pl. xxiii, fig. 4.

Size.—A specimen in Mr. Vicary's Collection measures 15 mm. high and 13 mm. wide.

Localities.—From Lummaton there is a specimen in the Torquay Museum, and another, which is very poor, in the Bristol Museum. From Wolborough there is a specimen in the Museum of Practical Geology. From Chudleigh there are five specimens in Mr. Vicary's Collection.

Remarks.—This seems a very variable species, so much so that I should have been inclined to separate its extreme varieties were they not connected by intermediate specimens. The variation is caused by the differences in strength of the different lines of ornament; thus the upper spiral ridges are sometimes large, and sometimes very small, and the cross striæ on the sinus-band are sometimes strong, straight, distant rungs, and sometimes fine, close, arched threads. The shape of the shell also varies considerably: sometimes, for instance, the whorls are much more overhanging, and sometimes the base is comparatively flat. Nevertheless, the specimens all seem to preserve a general character, and I have no doubt that they all belong to one species.

The fossil described by Phillips as *Pl. monilifera* in the 'Pal. Foss.' evidently represents this shell. His figure is very defective, and seems to present some differences, but his description leaves no doubt of its identity, especially in view of the great variability of the species. *Pl. monilifera*, however, as previously described by him from Yorkshire,¹ is totally distinct, and could by no possibility be the same as our Devonshire shell. As seen in specimens in the British Museum, one of which is figured in the "Geology of Yorkshire," its ornamentation is quite different, there being, for instance, no smooth median band. As reproduced by de Koninck² (who gives a long synonymy) it differs in being more turbiniform, and in having finer, though somewhat similar, sculpture, no smooth median band, a greater sutural angle, and a more circular mouth.

Affinities.—*Trochus Bouei*, Steininger,³ with which Phillips compared his Devonian species, was figured without a description, but the figure represents a shell ornamented with tubercles in a very different style.

The Carboniferous *Pl. Goeppertii*, Goldfuss,⁴ is very similar in shape, but its ornament consists of first a plain surface, then a double row of tubercles, then a concave sinus-band, and then another double row of tubercles.

Pl. seminuda appears to be less trochiform in shape, and to have much coarser ornamentation.

¹ 1836, Phillips, 'Geol. Yorks.,' pt. 2, p. 227, pl. xv, fig. 10 a.

² 1842-4, de Koninck, 'Desc. Anim. Foss.,' p. 387, pl. xxxiv, figs. 2 a, 2b.

³ 1834, 'Mém. Soc. Géol. Fr.,' vol. i, p. 371, pl. xxiii, fig. 4.

⁴ 1844, Goldf., 'Petref. Germ.,' vol. iii, p. 69, pl. clxxxv, fig. 7.

8. PLEUROTOMARIA SEMINUDA, n. sp. Pl. XXVIII, fig. 1.

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| 1840. | PLEUROTOMARIA CIRRIFORMIS? | Sowerby. | Geol. Trans., ser. 2, vol. v, pt. 3,
pl. lvii, fig. 17 (not Min. Conch.). |
| ? 1853. | — | CRENATOSTRIATA, Sandberger (pars). | Verst. Rhein.
Nassau, p. 188, pl. xxiii, fig. 2 d (only). |
| 1854. | — | CIRRIFORMIS, Morris. | Catal. Brit. Foss., p. 272. |
| 1888. | — | — | Etheridge. Foss. Brit., vol. i, Pl. p. 164. |

Description.—Shell rather small, trochiform. Spire of four or more rapidly-increasing narrow whorls. Suture simple, horizontal, deep. Whorls bluntly triangular, spreading out obliquely with a slight convexity from the suture to their widest part, where they turn through a blunt angle, and then slope in for a short distance to the lower suture. Body-whorl large, uniform with the upper whorls, arching in below to form a wide flattish base. Sinus-band situate on the widest part of the whorls, wide, concave, bounded by two large prominent rounded ridges or keels, of which the lower is the more prominent. Ornament consisting of a third indistinct keel a short distance below the sinus-band, and of coarse transverse ribs arching gently back from the suture, and recurved on the sinus-band. Umbilicus and mouth unseen.

Size.—Height 14 mm., width 14 mm.

Locality.—Wolborough. There is a specimen in the Battersby Collection of the Torquay Museum, and another in the Woodwardian Museum.

Remarks.—The above description is taken from the Battersby specimen, which is, unfortunately, in so poor a state of preservation that the ornamentation is almost entirely obliterated. It was evidently a beautiful shell. The sides of the whorls are flattened and expanding, being at first a little convex and then a little concave before they reach the sinus-band.

As far as can be judged from the figure of Sowerby's cast, it is identical with his *Pl. cirriiformis* of the 'Geol. Trans.,' but it differs much from the shell previously described by him under that name in the 'Min. Conch.,'¹ which is a finely cancellated shell of a different shape, and with a very differently arranged sinus-band.

Affinities.—This shell approaches the shorter of Sandberger's two figures of *Pl. angulata*, Phill. sp.,² but it differs from it in having flatter and more angular whorls, and having the sinus-band narrower, and situated lower down on the

¹ 1817, Sowerby, 'Min. Conch.,' vol. ii, p. 160, pl. clxxi, fig. 2.

² 1853, Sandberger, 'Verst. Rhein. Nassau,' p. 204, pl. xxiv, fig. 19 (only).

whorl. *Murchisonia angulata*, Phillips,¹ is a much more elevated shell, while *Pl. angulata*, Sowerby,² is totally distinct from both species.

Pl. Daleidensis, F. Römer,³ is very similar, and seems to agree in ornamentation, but it differs in being shorter and more cone-shaped, and in having a much narrower and less prominent sinus-band.

Pl. striata, Goldfuss,⁴ also seems somewhat similarly ornamented, but is distinguished by being much flatter, with differently shaped whorls, more numerous spiral ridges, and a flatter and less prominent sinus-band. With this shell Sandberger identifies his *Pl. crenatostrata*,⁵ which differs from the present form in much the same particulars. He, however, figures, as an elevated variety, a very dissimilar shell, which comes very much nearer to it, and may possibly be identical. It has, however, less expanded and more slowly increasing whorls, its sinus-band seems higher up, its transverse ornamentation is much better shown, and its boundary ridges are hardly so prominent.

Pl. exaltata, d'Archiac and de Verneuil,⁶ is distinguished by its broad convex sinus-band.

Pl. trochoides differs in having well-defined ridges or keels on the upper part of the whorls.

9. PLEUROTOMARIA ASPERA, Sowerby.

1840. PLEUROTOMARIA ASPERA, Sowerby. Geol. Trans., ser. 2, vol. v, ser. 3, pl. liv, fig. 16.

1841. — — Phillips (pars). Pal. Foss., p. 96, pl. xxxvii, fig. 177 c (only).

1854. — — Morris. Catal. Brit. Foss., p. 272.

Remarks.—Sowerby's original specimen from Plymouth is in the Woodwardian Museum, and is a beautiful and very distinct shell. Phillips quotes it from Pilton, South Petherwyn, and Newton, but his figures seem to include more than one species, the figure 177 c alone agreeing with Sowerby's type. In the 'Geol. Mag.' for 1889⁷ I separated the shell represented by figs. 177 a and b under the name of *Pl. distinguenda*. I then thought that two poor specimens from Wolborough in the Museum of Practical Geology belonged to that shell, but a further examination

¹ 1841, Phillips, 'Pal. Foss.,' p. 101, pl. xxxix, fig. 189.

² 1839, Sowerby, in Murchison's 'Sil. Syst.,' p. 641, pl. xxi, fig. 20.

³ 1844, F. A. Römer, 'Rhein. Uebergangsgeb.,' p. 80, pl. ii, figs. 7 a, b.

⁴ 1844, Goldfuss, 'Petref. Germ.,' vol. iii, p. 61, pl. clxxxii, fig. 4.

⁵ 1853, Sandberger, 'Verst. Rhein. Nassau,' p. 188, pl. xxiii, figs. 2, 2 a—d.

⁶ 1842, d'Archiac and de Verneuil, 'Geol. Trans.,' ser. 2, vol. vi, pt. 2, p. 361, pl. xxxiii, fig. 5.

⁷ 1889, 'Geol. Mag.,' dec. 3, vol. vi, p. 30.

has since caused me to refer them to a different species. I have met with no other specimens belonging to either of these two forms; and consequently it must remain doubtful to which of them the shell which Phillips quotes from Newton belongs.

The shell which Phillips gives in his fig. 177*, and speaks of as "perhaps a cast of this species," belongs apparently to *Pl. victrix*. As he does not quote Newton as a "doubtful" locality, it seems unlikely that this is the only shell referred to from that place.

10. PLEUROTOMARIA CANCELLATA, *Phillips*. Pl. XXVIII, fig. 4.

1841.	PLEUROTOMARIA CANCELLATA, <i>Phillips</i> .	Pal. Foss., p. 96, pl. xxxvii, figs. 176 a—c, f.
1849.	—	— <i>d'Orbigny</i> . Prodrome, vol. i, p. 69.
1854.	—	— <i>Morris</i> . Catal. Brit. Foss., p. 272.
1888.	—	— <i>Etheridge</i> . Foss. Brit., vol. i, Pl., p. 164.

Description.—Shell small, moderately elevated, turbiniform. Spire rather low, consisting of three or four rather quickly increasing whorls. Suture deep, obtuse. Whorls rounded, subquadrate, sloping out flatly from the suture, very convex on the shoulder, slightly convex on the back, and curving in rapidly to the base. Sinus-band situated about the middle of the back, some distance above the lower suture, narrow, concave, and excavate. Ornament consisting of four or five strong distant spiral ridges above the sinus-band, and more numerous similar ridges below it and on the base; crossed and decussated above the sinus-band by similar, distant, transverse ridges which slope obliquely backwards from the suture. Mouth sub-circular. Columella arched. Umbilicus very small. Shell-structure rather thick.

Size.—Height 8 mm., width 9 mm.

Locality.—There are two worn specimens in the Museum of Practical Geology, one of which is on the same slab of rock as a specimen of *Scoliostoma texatum*.

Remarks.—The specimen from which the above description is taken has suffered much from decortication, but the ornamentation can be fairly seen. It appears to agree fairly well with the smaller figure which Phillips gives of *Pl. cancellata*, and there seems to be no doubt that it belongs to that species. Whether Phillips' second figure does not belong to a different species appears to be doubtful. It represents a very much larger and more definitely cancellated shell. It is clear from his drawing that it came from Wolborough.

In the same year that Phillips described this species Münster¹ described another shell under the same name from the St. Cassian beds. To the latter shell d'Orbigny²

¹ 1841, Münster, 'Beitr.,' pt. 4, p. 113, pl. xii, fig. 13.

² 1849, d'Orbigny, 'Prodrome,' vol. i, p. 195.

has given the name *Pl. subcancellata*, leaving Phillips' name for the present form unchanged. As I have no other evidence as to the priority, I have followed d'Orbigny in this point.

Affinities.—The English specimens of *Pl. Orbigniana*, d'Archiac and de Verneuil, seem to have less quadrate whorls, and the sinus-band is situated very much farther from the suture, near the base instead of in the centre of the whorls. These points are less distinctly shown in the Sandberger's figures of the German shell. Its ridges also appear to be wider apart, and the transverse striæ finer and more oblique.

Pl. subclathrata, Sandberger, is a much more angulated shell.

Pl. subimbricata, Whidborne, is more conical, and has very much more numerous and finer striæ and a rather higher sinus-band.

11. PLEUROTOMARIA CHUDLEIGHENSIS, *Whidborne*. Pl. XXVIII, figs. 2, 3, 3a.

cf. 1860. PLEUROTOMARIA BODANA, *F. A. Römer*. Beitr., pt. 4, p. 163, pl. xxv,
figs. 16 a, b.

1889. — CHUDLEIGHENSIS, *Whidborne*, Geol. Mag., dec. 3, pt. 6,
p. 30.

Description.—Shell small, ovate, turbinate, few whorled. Spire conical, rather depressed, of four subangulated whorls. Suture deep, acute, facing upwards. Whorls regularly and moderately convex in general shape, covered with strong spiral ridges. Sinus-band on shoulder just above the widest part of whorl, rather elevated, bounded by two strong narrow ridges giving the angulated appearance to the whorl, and sometimes bisected by a fine median thread. Ornament consisting of two strong acute ridges below the suture, of which the first forms the steep side of the suture, and which are followed by two fine threads; after which come the ridges or keels of the sinus-band, and then over the back and base of the whorl about twenty regular, smaller, spiral ridges or coarse threads, occasionally alternating, which diminish as they approach the umbilicus; the whole series of spiral lines being crossed and knotted by fine and closer longitudinal threads, which sweep obliquely back from the suture, arch suddenly forward in the sinus-band, and then gradually curve over the back of the shell till on the lower part they again slope backwards, but begin to curve forwards again at the extreme inferior point. Umbilicus small, rounded. Columella twisted, curved, and rounded. Mouth sub-circular or sub-polygonal, posteriorly obtuse, knotted at the keel. Lips blunt. Shell-structure thick.

Size.—One specimen is 14 mm. high and 16 mm. wide; another is 17 mm.

high and 15 mm. wide. The specimens, though perfect, appear to be generally distorted, and probably the true measurement would come between these two.

Locality.—From Chudleigh there are two specimens in Mr. Vicary's Collection and another in the Woodwardian Museum. From Wolborough there is a specimen in the Museum of Practical Geology.

Remarks.—These shells come very near to *Pl. subimbricata*, but in the opinion of Mr. Roberts and myself are certainly distinct from it. The character of the ridges is different, being less uniform and stronger; the suture is deeper and more acute, the whorls broader and less swollen, the sinus-band higher up, and the transverse markings much stronger and more definite.

Affinities.—*Pleurotomaria Bodana*, F. A. Römer,¹ so closely resembles this species that I am in some doubt whether it may not be identical. Römer's description is very slight and agrees as far as it goes, but his figure presents several differences. Its shape seems slightly shorter and more trochiform, the sinus-band seems smaller and of a different character, wanting the bounding ridges and being more strongly barred, and there are no signs of stronger ridges near the suture. Hence it must probably be regarded as distinct.

Turbo canaliculatus, F. A. Römer,² is somewhat similarly marked, but the shell is flatter, and the mouth is more expanded, while the main keel is lower down on the whorls and shows no signs of any cross marks that would suggest its being a *Pleurotomaria*.

An indistinct specimen figured by Phillips³ as "perhaps a cast of" *Pl. aspera*, Sowerby, appears not unlike this species in general character, but differs in having the sinus-band decidedly lower down on the whorl, and may more probably be referred to *Pl. victrix*.

12. PLEUROTOMARIA SUBIMBRICATA, n. sp. Pl. XXVIII, figs. 5—8.

1855. PLEUROTOMARIA IMBRICATA, *McCoy* (not F. A. Römer). Brit. Pal. Foss., p. 393.

Description.—Shell rather small, spirally conical, turbinate, few-whorled, pointed. Spire of four rather narrow, rapidly increasing volutions. Apex acute. Suture well-marked, obtuse. Whorls obliquely expanding in a slightly convex curve from the suture to the back, which is narrow and convex, and then curving rapidly in to form an oblique and slightly convex base. Upper whorls

¹ 1860, F. A. Römer, 'Beitr.,' pt. 4, p. 163. pl. xxv, figs. 16 a, b.

² 1843, F. A. Römer, 'Verst. Harzgeb.,' p. 29, pl. vii, fig. 14.

³ 1841, Phillips, 'Pal. Fos.,' p. 96, pl. xxxvii, fig. 177.

exposed to about the centre of the back. Sinus-band narrow, flat or concave, prominent, situate upon the shoulder just above the widest part, bounded and sometimes bisected by fine or coarse threads. Ornament consisting of nine to fourteen fine, alternating, spiral threads above the sinus-band, and very numerous similar alternating threads below it and upon the base. Transverse ornament consisting of a few more or less indistinct broad bulges near the suture, and very fine oblique striæ, which are seen to be very acutely deflected at the sinus-band, but are so indistinct as to be almost invisible. Mouth unseen. Umbilicus small, deep. Shell-structure thin.

Size.—A specimen measures 15 mm. high and 13 mm. wide; another measures 20 mm. high and 19 mm. wide.

Localities.—In the Woodwardian Museum are two specimens from Wolborough, which were described by M'Coy as *Pl. imbricata*, F. A. Römer, and a third from Lummaton, which was collected by Mr. E. B. Tawney and referred by him (on the museum label) to *Pl. aspera*, Phillips. In the Museum of Practical Geology are three examples from Wolborough, and in the Torquay Museum is a small specimen from Lummaton.

Remarks.—The distinctive features in this shell are the narrow, elevated sinus-band, and the numerous fine and rather irregular spiral threads on the rest of the surface. The transverse ornament is so fine as rarely to be detected. In Mr. Tawney's specimen the spiral threads are more numerous and alternating than in the Torquay fossil, and the sinus-band is deeply concave, while in the latter it is filled by one or two coarse threads. One of the specimens in the Museum of Practical Geology has the sinus-band lower down and the spiral lines above it very fine; it presents rather a peculiar appearance, due to the slightly convex and oblique upper parts of the whorl, which, being very wide and enveloping a great part of the whorl above, cause the spire to have a gently undulating contour, broken only by the flatter perpendicular sinus-band. I formerly regarded this specimen as distinct, but a further examination leads me to believe that it is nothing more than a variety of the present species.

Pl. imbricata, as originally described by F. A. Römer,¹ is extremely like the English fossils, but it presents some minor differences from them. Thus the transverse striæ are more strongly marked, the sinus-band is much wider, the sutures are deeper, and the shape of the shell is flatter. Clarke² redescribes Römer's specimens, and states that the transverse marks are really almost imperceptible, but he describes the shell as even flatter than does Römer, and the sinus-band as being much higher or broader than it is in the English fossils. I am therefore in much doubt as to whether M'Coy is to be followed in his identifi-

¹ 1843, F. A. Römer, 'Verst. Harzgeb.,' p. 28, pl. 8, fig. 1.

² 1884, Clarke, 'Neues Jahrb. f. Min.,' Beil.-Band iii, p. 341.

cation. The height of the shell and the narrowness of the sinus-band seem constant differences in the English specimens from Römer's shell, and therefore upon the whole I think that it is safest to regard them as distinct. Other differences also probably exist; for instance the base of the shell seems to be decidedly more oblique.

Affinities.—*Pl. aspera*, Sowerby,¹ differs entirely in the character of its ornament, which is definitely reticulate, and in its convex sinus-band.

Pl. Chudleighensis is distinguished by the fewness and coarseness of its spiral lines, the distinctness of its transverse striæ, the greater length of the shell, and the higher position of the sinus-band.

Pl. rotundata, F. A. Römer,² appears to differ in being more discoid, and in having fewer spiral ridges and more definite transverse striæ, which form a reticulation with the ridges.

Pl. decussata, var. *evexicosta*, Sandberger,³ which seems to be identical with *Pl. imbricata*, differs in being a much flatter shell with a broader sinus-band, and more decussated and indistinct ridges.

Pl. carinata, Sowerby,⁴ sp., and *Pl. striata*, Sowerby, sp.⁵ are clearly distinct, for they are transversely instead of spirally striated, as also are *Pl. striata*, as given by de Koninck,⁶ and the Canadian *Pl. Delia*, Billings.⁷

The conical specimen in the Museum of Practical Geology mentioned above very nearly agrees in contour and other particulars with *Pl. Lindstromi*, Ehlert,⁸ which is evidently very nearly allied. That species may, however, be distinguished by its depressed and narrower sinus-band, by the absence of an umbilicus, by the much greater indistinctness of the spiral threads, and by the clearness of the growth-lines.

Pl. filitexta, Hall,⁹ has a rather lower spire, and is marked by clear transverse as well as very fine and numerous spiral lines.

In *Pl. Wurmi*, F. A. Römer,¹⁰ the spiral lines are nodulated by transverse striæ.

¹ 1840, Sowerby, 'Geol. Trans.,' ser. 2, vol. v, p. 3, pl. liv, fig. 16; and 1841, Phillips, 'Pal. Foss.,' p. 96, pl. xxxvii, fig. 177 c.

² 1855, F. A. Römer., 'Beitr.,' pt. 3, p. 35, pl. vii, figs. 4 a, b; and 1884, Clarke, 'Neues Jahrb. f. Min.,' Beil.-Band iii, p. 344.

³ 1853, 'Sandberger,' 'Verst. Rhein. Nassau,' p. 197, pl. xxiv, figs. 4, 4 a.

⁴ 1813, Sowerby, 'Min. Conch.,' vol. i, p. 34, pl. x, upper and lower figures.

⁵ 1817, *ibid.*, vol. ii, p. 159, pl. 171, fig. 1.

⁶ 1842-4, de Koninck, 'Desc. Anim. Foss.,' p. 399, pl. 31, fig. 2; and 1883, de Koninck, 'Ann. Mus. Roy. H. N. Belg.,' vol. viii, pt. 4, p. 32, pl. xxii, figs. 19-22.

⁷ 1874, Billings, 'Palæozoic Fossils,' vol. ii, pt. 1, p. 61, pl. v, fig. 3.

⁸ 1887, Ehlert, 'Bull. Soc. d'Étud. Sci. d'Angers,' p. 28, pl. viii, figs. 6, 6 a.

⁹ 1879, Hall, 'Pal. N. Y.,' vol. v, pt. 2, p. 74, pl. xx, figs. 26, 27; and pl. xxviii, figs. 15-17.

¹⁰ 1843, F. A. Römer, 'Verst. Harzgeb.,' p. 27, pl. vii, fig. 13; and 1884, Clarke, 'Neues Jahrb. f. Min.,' Beil.-Band iii, p. 343.

13. PLEUROTOMARIA SHALERI, n. sp. Pl. XXVIII, figs. 9, 9 a.

1844. SCHIZOSTOMA VITTATUM, Goldfuss. Petref. Germ., vol. iii, p. 79, pl. clxxxviii, fig. 6 a, b.

? 1853. PLEUROTOMARIA EUOMPHALUS, Sandberger. Verst. Rhein. Nassau, p. 187, pl. xxii, figs. 12, 12 a, b.

Description.—Shell rather small, discoidal, very short. Spire flat, of four or five slowly increasing whorls. Suture apparently very deep, facing upwards. Whorls sub-circular in section, rising convexly from the suture to their highest part, where there is an excavated flat sinus-band, about one-fifth the width of the whorl, and bounded by sharp edges. Ornament consisting of close fine lines or threads, arching backwards from the suture, curving round in the sinus-band, sloping forward below it and gradually becoming perpendicular on the back. Back of the whorl flatly convex.

Size.—Height about 5 mm., width about 21 mm.

Locality.—There are two badly preserved specimens in the Torquay Museum which probably came from Lummaton, and another, equally indistinct, in the Woodwardian Museum from the same locality.

Remarks.—The specimens from which the above description is taken are in a very unsatisfactory state of preservation. Their surface is so decayed and damaged by matrix that it is most difficult to make out the character of the ornamentation. They appear to be very similar to *Schizostoma vittatum*, Goldfuss, and most probably belong to the same species, although one or two differences may be observed in that Eifelian shell, *e. g.* its sinus-band seems broader and not sunk below the rest of the surface, and its striæ seem to be finer.

Pleurotomaria euomphalus, Sandberger,¹ seems at first sight to correspond exactly with our shell, but it differs from it in the one important point of having a raised sinus-band between two slight furrows. This point is not very clearly shown in Sandberger's figure, and, but for this, the resemblance between the two species is so great that they would certainly be placed together.

The name *Pl. vittata*² was used for a very different shell by Phillips some years before Goldfuss named the present shell, and consequently a fresh name must be found for the latter. It does not seem safe to use Sandberger's name in consequence of the difference mentioned above; I therefore propose to rename it after my friend Professor H. Shaler Williams, of Cornell University, one of the foremost American workers in Devonian Geology.

¹ 1853, Sandberger, 'Verst. Rhein. Nassau,' p. 187, pl. xxii, figs. 12, 12 a, b.

² 1836, Phillips, 'Geol. Yorks.,' pt. 2, p. 228, pl. xv, fig. 24.

Affinities.—*Sch. tæniatum*, Goldfuss,¹ and *Sch. fasciatum*, Goldfuss,² besides having elevated sinus-bands, are also distinguished by the possession of a few more spiral ridges on their whorls.

14. PLEUROTOMARIA DELPHINULOIDES, *Schlotheim*, sp. Pl. XXVIII, figs. 10—13.

1821. *HELICITES DELPHINULOIDES*, *Schlotheim*. Petrefact., p. 102, p. xi, fig. 4.
 1842. *PLEUROTOMARIA DELPHINULOIDES*, *d'Archiac* and *de Verneuil*. Geol. Trans., ser. 2, vol. vi, pt. 2, p. 361, pl. xxxiii, figs. 4, 4 a.
 1843. — *SUBLÆVIS*, *F. A. Römer*. Verst. Harzgeb., p. 27, pl. vii, fig. 9.
 ? 1843. *EUOMPHALUS DIONYSII*? *F. A. Römer*. Ibid., p. 30, pl. viii, figs. 3 a, b.
 1844. *SCHIZOSTOMA DELPHINULOIDES*, *Goldfuss*. Petref. Germ., vol. iii, p. 78, pl. clxxxviii, figs. 3 a—d.
 1853. *PLEUROTOMARIA DELPHINULÆFORMIS*, *Sandberger*. Verst. Rhein. Nassau, p. 188, pl. xxiii, figs. 1, 1 a—e.
 1860. — *DELPHINULIFORMIS*, *Eichwald*. Lethæa Rossica, p. 1172, pl. xliii, figs. 3 a, b.
 1874. — *LYDIA*, *Billings*. Palæozoic Fossils, vol. ii, pt. 1, p. 62, pl. v, figs. 4, 4 a.
 1876. — *DELPHINULOIDES*, *F. Römer*. Leth. Pal., pl. xxxii, fig. 7.
 1884. — *SUBLÆVIS*, *Clarke*. Neues Jahrb. f. Min., Beil.-Bd. iii, p. 340.
 1887. — *VIENNAYI*, *Æhlert*. Bull. Soc. d'Étud. Sci. d'Angers, p. 30, pl. ix, figs. 2, 2 a, b.
 1887. — *MELNIKOVI*, *Tschernyschew*, Mém. Com. Géol. Russ., vol. iii, No. 3, p. 169, pl. v, figs. 8 a—c.
 1889. — *DELPHINULOIDES*, *Whidborne*. Geol. Mag., dec. 3, vol. vi, p. 30.

Description.—Shell sometimes very large, turbiniform, more or less elevated, of four or five rather slowly increasing volutions. Spire rather variable in height, broadly conical, symmetrical with the body-whorl, generally exposing the greater part of the whorls. Suture deep, narrow, acute. Whorls roundly convex, sub-circular or sub-elliptic, arching horizontally or obliquely from the suture to the back, which is generally flatly perpendicular for a short distance, and then curving more or less in to the lower suture, or in the case of the body-whorl arching round the base to the umbilicus with a deep symmetrical curvature. Sinus-band very broad, supra-sutural, flat or slightly convex, level with the rest of the surface, situated slightly above the centre of the back, generally bounded by very fine, low, raised, rounded threads or blunt angles, and sometimes bisected by an indis-

¹ 1844, Goldfuss, 'Petref. Germ.,' vol. iii, p. 79, pl. clxxxviii, figs. 4 a—c.

² Ibid., p. 79, pl. clxxxviii, figs. 5 a, b.

tinct median line. Surface nearly smooth, ornamented by fine irregularly grouped growth-lines, that start perpendicularly from the suture, arch back to the sinus-band, which they cross in a shallow concave arc or curve, and then seem to become rather stronger on the base of the shell. Surface below the suture sometimes covered by multitudinous, very fine, low, close, rounded threads. Umbilicus large and deep. Mouth emarginate, sub-circular or sub-elliptic. Lips sharp, continuous. Shell-structure rather thin.

Size.—Height 42 mm., width 42 mm. A small flat specimen measures 9 mm. high, 14 mm. wide.

Localities.—In Mr. Vicary's Collection are three specimens from Chudleigh and thirteen from Wolborough; in my Collection two from Chudleigh and one from Wolborough; in the Torquay Museum six, some probably from Lummaton and some from Wolborough; in the Museum of Practical Geology three from Wolborough; and in the British Museum one from Lummaton and one from Wolborough.

Remarks.—*Helicites delphinuloides*, Schlotheim, is a very common and well-known shell, which has been frequently figured and described under various names by foreign authors. These figures show the great variability of the species, and the same fact is borne out by an examination of our English examples. They vary greatly in the height of the spire, the rate of increase and number of the whorls, and the shape of their section. Unfortunately these specimens are for the most part defective or decayed and cannot therefore be compared as completely as could be wished. In spite of their variability, however, they all appear to have the same general character, and there is little doubt that they all belong to Schlotheim's species. His figure represents a specimen of medium height, and shows the broad sinus-band bounded by a raised thread, and the obliquely longitudinal striæ above and below it.

D'Archiac and de Verneuil and also Sandberger figure two extreme varieties, and the former authors suggest that one of theirs, which is exactly like the most elevated of our shells, may possibly prove to be a distinct species. The specimens now before us from their constant variability do not point to this, and probably the possession of a few more good examples would fill up the gaps which still exist.

Sandberger gives no reason for changing the name of his shell.

Eu. delphinuliformis as given by Eichwald is much more elevated, and perhaps increases less rapidly; but in view of the variability of the species it may probably be regarded as simply a variety. It is longer than wide, and smooth except for the sinus-band.

Euomphalus Dionysii? F. A. Römer looks just like the cast of a rather elevated form of this shell. Some of Mr. Vicary's specimens almost exactly agree with Römer's figure. In his later work, however, Römer refigures his species under the

name of *Pl. lævis*,¹ and that shell, which differs considerably from his former, is distinguished from the present species by its more globose shape and narrower convex sinus-band, and by having two or three indistinct spiral lines near the suture. It is to be noted that when the surface is worn away it is often difficult to separate specimens of our shell from *Eu. circularis*.

Pl. Melnikovi, Tschernyschew, also appears to be an extremely elongated variety. Being only figured as a cast, however, it is possible that the ornamentation may prove different.

I am not very certain whether *Pl. Viennayi*, Ehlert, should be regarded as a synonym of the shorter variety; the only distinction seems to be that the sinus-band is situated slightly higher on the whorls than usual.

Pl. sublævis, F. A. Römer, and, as far as can be judged, *Pl. Lydia*, Billings, seem accurately to agree with some of our varieties.

Affinities.—In 1817 Sowerby described a shell from the Carboniferous of Derbyshire under the name of *Pl. cirriformis*,² but both his figure and description are too indistinct to be recognisable. In the 'Geol. Trans.'³ he doubtfully identifies with it a water-worn cast from Plymouth, remarking that the true *Pl. cirriformis* is found at Paffrath and is the *Pl. delphinuloides* of foreign authors. The Plymouth shell is, I believe, really a specimen of *Pl. seminuda*; while an examination of Sowerby's type specimen of the original *Pl. cirriformis*, which is now in the British Museum, shows that it is totally distinct from either. The shape of its whorls is different; the sinus-band is elevated, flat, narrow, and very coarsely marked with irregular arched striæ; the surface above the sinus-band is finely but distinctly cancellated. I do not think that any of the *Pleurotomariæ* from Devonshire can be referred to Sowerby's species.

D'Archiac and de Verneuil suggest that *Pl. vittata*, Phillips,⁴ should be regarded as an intermediate variety, and there is certainly nothing in either Phillips' figure or description to differentiate it. His type specimen, however, and other specimens in the British Museum show that it is quite distinct. Its shape is much more elongate and ovoid, its whorls are more evenly rounded, and its sinus-band is flatly convex and bounded by depressed striæ. Moreover its growth-lines are finer and there is no umbilicus. In general shape it somewhat resembles the shell referred by me to *Natica meridionalis*, Phillips. It is placed by de Koninck in his sub-genus *Rhineoderma*.

The shell described as *Pl. delphinuloides*? by de Koninck⁵ (with a long

¹ 1850, F. A. Römer, 'Beitr.,' pt. 1, p. 37, pl. v, fig. 27.

² 1817, Sowerby, 'Min. Conch.,' vol. ii, p. 160, pl. 171, fig. 2.

³ 1840, *ibid.*, 'Geol. Trans.,' ser. 2, vol. v, pt. 3, pl. lvii, fig. 17.

⁴ 1836, Phillips, 'Geol. Yorks.,' vol. ii, p. 228, pl. xv, fig. 24.

⁵ 1842-4. de Koninck, 'Desc. Anim. Foss.,' p. 377, pl. xxxvi, fig. 4.

synonymy) evidently does not belong to this species, as it has sharp angulated whorls and a much smaller umbilicus.

Pl. elliptica, Münster,¹ has a narrow concave sinus-band upon an elevated rim.

Pl. undulata, F. A. Römer,² seems to have much flatter sides, more angulated whorls and a much narrower sinus-band. Ferd. Römer³ considers it distinguished by its shortness and its triangular mouth. Some specimens of the present shell, however, are certainly very short.

Pl. plena, Hall,⁴ is a more exactly conical shell, less umbonated, with a lower sinus-band, which is partially covered by the succeeding whorl, and with fine transverse striae only.

Pl. Koltubanica, Tschernyschew,⁵ is a small shell which differs in having spiral ridges on the upper part of the whorls and a still wider sinus-band.

15. *PLEUROTOMARIA DISSIMULATRIX*, n. sp. Pl. XXVIII, fig. 17.

Description.—Shell large, turbate, rather elevated, of three or four volutions. Spire increasing rather quickly. Suture deep, rectangular. Whorls sub-circular in section, nearly flat at the suture, and most convex on the shoulder and at the lower angle. Body-whorl very much swollen. Sinus-band narrow, elevated, bounded by indistinct ridges, situated in the centre of the back. Ornament consisting of coarse, oblique, rounded, transverse ridges, arching back from the suture, and apparently of one or two coarse indistinct spiral ridges near the sinus-band.

Size.—Height, 38 mm.; width about 38 mm.

Locality.—Wolborough. There are four very defective specimens in the Museum of Practical Geology, and a very doubtful specimen in the British Museum.

Remarks.—Only two of these specimens show much character; the others being almost unrecognisable. Even these are too obscure to permit a complete definition of the species, or even certainty as to its true position. The distinctive features are the narrow elevated sinus-band, the sub-quadrate or sub-circular section of its whorls; and the coarse oblique striae. As in these points it differs from *Pl. delphinuloides*, I do not think it can be regarded as a variety of that shell. It more nearly approaches *Pl. victrix*, but the shape and the ornamentation are apparently different, the spiral lines dominating in the one, and the oblique

¹ 1844, Goldfuss, 'Petref. Germ.', vol. iii, p. 67, pl. clxxxiii, fig. 9.

² 1843, F. A. Römer, 'Verst. Harzgeb.', p. 28, pl. vii. figs. 10a, b.

³ 1844, F. Römer, 'Rhein. Uebergangsgeb.', p. 80.

⁴ 1879, Hall, 'Pal. N. Y.', vol. v, pt. 2, p. 66, pl. xvii, figs. 11—13.

⁵ 1887, Tschernyschew, 'Mém. Com. Géol. Russ.', vol. iii, No. 3, p. 170, pl. 6, figs. 10—11.

in the other; moreover the direction of the oblique lines is very different, and one or two other distinctive features exist which prevent its union with it, which, chiefly from the paucity of the material, I was at one time inclined to propose.

Affinities.—*Schizostoma costatum*, Goldfuss,¹ is sinistral, and its ridges seem fewer and less oblique than those of the present species. Its sinus-band also appears much narrower, like that of the genus *Porcellia*.

Worthenia Munsteriana, de Koninck,² has a larger and more elevated spire.

Pl. Larteti, Ehlert,³ is very similar, but is a more conical shell with more numerous whorls and a less inflated body-whorl.

16. PLEUROTOMARIA VICTRIX, *Whidborne*. Pl. XXVIII, figs. 15, 16.

? 1841. PLEUROTOMARIA ASPERA, *Phillips* (pars), not *Sowerby*. Pal. Foss., p. 223, pl. xxxvii, fig. 177* only.

1854. — — *Morris*, Catal. Brit. Foss., p. 272.

1889. — VICTRIX, *Whidborne*, Geol. Mag., dec. 3, vol. vi, p. 30.

Description.—Shell large, turbate, rather elevated, angulated, of about four volutions. Spire increasing rather slowly, somewhat elevated. Suture simple, deep, rather broad. Whorls broad, sub-circular, much exposed, moderately convex above, the curvature increasing at the lowest and widest part, where there is a rapid rounding-in to form a spirally convex base. Sinus-band narrow, elevated, flat or slightly concave, bounded by a minute groove and edge, which become a ridge on the upper whorls; situated about the middle of the body-whorl, or in the upper whorls about twice its width above the suture. Ornament consisting of three fine equally distant threads above the sinus-band, and numerous close minute spiral threads on the base of the shell, the whole crossed by microscopic characteristic growth-striae which are unusually steep on the upper part of the whorls, and become coarser on the base so as to break the spiral threads.

Size.—Height about 27 mm.; width, 23 mm.

Localities.—There are two specimens in my collection from Lummaton, another fragment (probably of the same species) from Lummaton in the Bristol Museum, and a very poor specimen from Wolborough in the Godwin-Austen Collection in the Museum of Practical Geology.

Remarks.—Upon the upper whorls the spiral threads are so strong as to give a polygonal shape to its section, but upon the body-whorl they become very indistinct. This species comes near to *Pl. delphinuloides* in some respects, but it is more angulated than any of the varieties of that species, and also has a narrower

¹ 1844, Goldfuss, 'Petref. Germ.', vol. iii, p. 79, pl. clxxxviii, figs. 7 a, b.

² 1883, de Koninck, 'Ann. Mus. Roy. H. N. Belg.', vol. viii, pt. 4, p. 66, pl. xxxii bis, figs. 7, 8.

³ 1887, Ehlert, 'Bull. Soc. d'Étude Sci. d'Angers,' p. 25, pl. xxix, figs. 1, 1 a—e.

sinus-band, and is differently marked. Mr. Roberts and I think that it is to be regarded as a new species of the *Delphinuloides* type.

Affinities.—*Pl. Larteti*, Ehlert,¹ comes between this species and *Pl. delphinuloides*, being a more turbiniform shell without spiral striæ.

Pleurotomaria silurica, Eichwald,² is rather similar in general shape. It differs in being more elevated and angulated, in having no spiral lines above the suture, and in having the transverse marks very coarse.

Pl. aspera, Sowerby,³ is a widely different shell with coarse reticulate markings and a convex sinus-band; as also for the most part is Phillips' rendering⁴ of that species. The four figures given by the latter author are, however, so dissimilar that it seems probable that he has included more than one species under this head. Three of these are totally distinct from the present form; but the fourth, which he has separated from the rest, and described as "perhaps a cast of the above species," most probably represents an example of this shell. It is very similar in general shape, but Phillips' sketch seems to indicate that its ornamentation was coarser.

It appears very closely to resemble *Pl. cirriformis*, Sowerby, sp., but differs in being less reticulate and more trochiform, in having the sinus-band smaller, less convex, and higher on the whorls, and in having a shallower suture.

17. PLEUROTOMARIA CROKERI, n. sp. Pl. XXVIII, fig. 14.

Description.—Shell small, depressed, turbiniform, of few volutions. Spire forming a very low cone. Suture rather deep. Whorls elliptic in section, much wider than high, spreading out flatly from the suture with a gradually increasing curvature, very convex round the short back, and flattish on the base. Body-whorl very large. Sinus-band situate on the widest part of the whorls, elevated, convex, rather narrow, bounded by fine thread-like grooves, and marked by fine recurved striæ. Surface smooth, or marked only by indistinct growth-lines.

Size.—Height, 11 mm.; width, 17 mm.

Locality.—Wolborough. There is a specimen in the British Museum, and another doubtful specimen in the Museum of Practical Geology.

Remarks.—I have felt very doubtful whether these fossils were distinct, or whether they should be regarded as one of the numerous varieties of *Pl. delphinuloides*. They seem to differ from that species by having a narrower, convex, and

¹ 1887, Ehlert, 'Bull. Soc. d'Étude Sci. d'Angers,' p. 25, pl. ix, figs. 1, 1 a—e.

² 1860, Eichwald, 'Lethæa Rossica,' p. 1171, pl. xlv, fig. 11.

³ 1840, Sowerby, 'Geol. Trans.,' ser. 2, vol. v, pt. 3, pl. liv, fig. 16.

⁴ 1841, Phillips, 'Pal. Foss.,' p. 96, pl. xxxvii, figs. 177 a—c, 177*.

more elevated sinus-band, and by the greater flatness and peculiar slope of their whorls; and after several examinations I have come to the conclusion that there is reason for treating them as a separate species. The sinus-band may possibly have been bounded by ridges, but the state of preservation of the specimens does not permit evidence upon this point.

Affinities.—*Pl. naticiformis*, Sandberger,¹ exactly agrees with this species in shape, but is distinguished by its flat sinus-band which is divided into fine granules by three spiral furrows.

Pl. turbinea, Schnur,² is distinguished by its numerous fine spiral striæ and its more rounded and rapidly increasing whorls.

Pl. lævis, F. A. Römer,³ differs in having much more numerous whorls, which increase more slowly and are less elliptic. He says it is the same species as that which he formerly described as *Eu. Dionysii*?⁴ and which chiefly differs from the present by having a higher spire and shallower sutures. Clarke⁵ says there is little variation in that species, and that the sculpture is so fine that it is often difficult to recognise the sinus-band. Hence it is probably distinct from the present shell in which the sinus-band is very clearly seen.

I have named this specimen after the late Dr. Croker, of Bovey Tracy, an old student of the palæontology of Devonshire.

18. PLEUROTOMARIA GRACILIS, *Phillips*. Pl. XXVIII, fig. 18.

? 1840. EUOMPHALUS SUBCARINATUS, *Münster*. Beitr., pt. 3, p. 85, pl. xv, fig. 5.

1841. PLEUROTOMARIA GRACILIS, *Phillips*. Pal. Foss., p. 98, pl. xxxvii, fig. 181.

1854. — — — *Morris*. Catal. Brit. Foss., p. 272.

1888. — — — *Etheridge*. Foss. Brit., vol. i, Pal., p. 164.

Description.—Shell small, lenticular, much depressed, of about four volutions. Spire small, flatly conical. Suture narrow, linear, deep, simple. Whorls rather quickly increasing, rising from the suture and immediately curving with a decreasing curvature till the widest part of the whorl is reached, which is marked by the sinus-band, and immediately followed by the lower suture. Body-whorl rather large, similar to the other whorls above, and rapidly curving below to form

¹ 1853, Sandberger, 'Verst. Rhein. Nassau,' p. 192, pl. xxiii, figs. 4, 4 a—c.

² 1853, Steininger, 'Geogn. Beschreib. Eifel,' p. 47, pl. i, fig. 16; and 1853, Sandberger, 'Verst. Rhein. Nassau,' p. 192, pl. xxiii, figs. 5, 5 a—c.

³ 1850, F. A. Römer, 'Beitr.,' pt. 1, p. 37, pl. v, fig. 27.

⁴ 1843, *ibid.*, 'Verst. Harzgeb.,' p. 30, pl. viii, figs. 3 a, b.

⁵ 1884, Clarke, 'Neues Jahrb. f. Min.,' Beil.-Band iii, p. 340.

a flattish base. Mouth, umbilicus, and surface unknown. Sinus-band apparently very narrow, and rather elevated.

Size.—Height, 6 mm.; width, 11 mm.

Locality.—There is a specimen apparently from Lummaton in the Torquay Museum.

Remarks.—I have been unable to find the type specimen of *Pl. gracilis*, but after careful consideration Mr. Roberts and myself came to the conclusion that the fossil described above must belong to that species. Phillips' figure of it represents a still flatter shell, with much broader whorls, but these differences may be due to the imperfection of the specimens. Thus, while the figure here given accurately represents one view of the Torquay specimen, its whorls seem, when viewed from another side, to be much more horizontally flattened, so that it much more nearly approaches Phillips' figure.

The specimen is very poor, its surface is lost, and it is impossible to say whether the body-whorl is not partly absent; but the size and shape of the sinus-band is clearly shown, and appears to be elevated, rounded, very narrow, and situate on the shoulder or widest part of the whorls. Phillips, on the other hand, writes of his fossil as if its sinus-band were depressed instead of elevated, but it is very difficult to be sure of his meaning.

It seems very probable that it is also identical with Münster's *Euomphalus subcarinatus*,¹ which only differs in having a rather more elevated band or keel, and rather more numerous and slowly increasing whorls, so that the spire is larger. As the umbilicus of our fossil is unseen, I do not feel sufficiently sure of its identity to adopt Münster's name, though I expect that it will ultimately prove that both the North and the South Devon shells will have to be referred to that species.

Affinities.—*Pleurotomaria sigaretus*, Sandberger,² is similar in general shape, but differs in its greater flatness, in the position of the sinus-band (which is not seen in Sandberger's figure), and in the section of the whorls being bluntly triangular instead of semi-elliptic.

Natica discus, F. A. Römer,³ is also almost exactly similar, and in the figure there are some signs of an (unmentioned) band as in our specimen. It is difficult to decide upon such slight evidence whether it is the same shell. Römer mentions some backward lines of growth which might point to its being a *Pleurotomaria*. Clarke,⁴ however, describes it under the name *Turbinilopsis discus*, F. A. Römer sp., and says that it is covered by microscopic spiral striæ.

¹ 1840, Münster, 'Beitr.,' pt. iii, p. 85, pl. xv, fig. 15.

² 1853, Sandberger, 'Verst. Rhein. Nassau,' p. 194, pl. xxiii, figs. 9, 9 a, 9 b.

³ 1852, F. A. Römer, 'Beitr.,' pt. 2, p. 88, pl. xiii, figs. 11 a, b.

⁴ 1884, Clarke, 'Neues Jahrb. f. Min.,' Beil.-Band iii, p. 351.

Pleurotomaria arata, Hall,¹ has a higher spire, a broader sinus-band, strong transverse ridges, and a more angulated section.

Euomphalus nanus, Eichwald,² has a much more depressed spire, and a decidedly deeper suture.

19. PLEUROTOMARIA BISCHOFFII, Goldfuss. Pl. XXXI, figs. 1, 1 a.

1844. PLEUROTOMARIA BISCHOFFII, Goldfuss. Petref. Germ., vol. iii, p. 65, pl. clxxxiii, fig. 4.

1853. — CALCULIFORMIS, Sandberger. Verst. Rhein. Nassau, p. 193, pl. xxii, fig. 14.

1889. — — Whidborne. Geol. Mag., dec. 3, vol. vi, p. 30.

Description.—Shell very small, lenticular, depressed, globose or turbate. Spire conical, very low, of five whorls. Suture very slightly marked. Whorls almost flat close to the suture, and then curving with a nearly semicircular curvature to form the sides of the shell. Upper whorls very much enveloped by those below. Surface smooth except that there are signs of a raised rounded sinus-band or keel, which is distant about half the width of the whorl from the suture. Shell-structure thick. Mouth and umbilicus hidden.

Size.—Height, 6 mm.; width, 10 mm.

Locality.—Lummaton. There is a specimen in the Woodwardian Museum, which was collected by Mr. E. B. Tawney from that place.

Remarks.—Except that there are signs of very minute spiral striæ, Sandberger's species corresponds exactly with our specimen. It agrees both in general shape and in the position and convexity of the sinus-band. Its aperture is possibly slightly larger, but there can, I think, be no doubt of its identity. The sinus-band in the English specimen is very indistinct, and but for the exact correspondence with Sandberger's species might well be overlooked, but a close examination leaves, I think, no doubt that it really exists.

Sandberger identifies his species with *Pleurotomaria Bischoffii*, Goldfuss³ which he describes as only a cast, though Goldfuss does not mention this. Goldfuss's figure is quite smooth and has perhaps more quickly increasing whorls and a wider sinus-band than the English shell. As no side view is given the elevation of the shell cannot be compared; but there is no cause for questioning the correct-

¹ 1879, Hall, 'Pal. N. Y.,' vol. v, pt. 2, p. 64, pl. xvii, figs. 1—10.

² 1857, Eichwald, 'Bull. Soc. Nat. Moscow,' p. 150; and 1860, 'Lethæa Rossica,' p. 1635, pl. lx, figs. 26 a—c.

³ 1844, Goldfuss, 'Petref. Germ.,' vol. iii, p. 65, pl. clxxxiii, figs. 4 a, b.

ness of Sandberger's identification; and as he gives no reason for changing the name of course Goldfuss's original name must stand.

Affinities.—This shell is so similar to *Rotellina helicina*, Münster sp., in general appearance that even Mr. Tawney supposed it to be the same shell, but it is clearly distinguishable by the presence of a sinus-band, by its more elevated spire, and its less discoid form. From *Pleurotomaria gracilis*, Phillips,¹ to which Mr. Tawney referred both shells, it is distinguished by its sinus-band being well within the shoulder instead of on the median line of the whorl, and by its more globose shape.

In *Pl. Brilonensis*, Kayser,² the sinus-band is much farther down from the suture.

Schizostoma bistriata, Münster,³ differs in having a depressed sinus-band which is not so high up on the shoulder, and in which the concave lines of growth are very visible.

2. Genus—MURCHISONIA (d'Archiac and de Verneuil Mss.), Phillips, 1841.

This genus is distinguished from *Pleurotomaria*, which it otherwise closely resembles, by its elongate turritid form and by the constant absence of an umbilicus. It occurs from the Silurian to the Trias.

1. MURCHISONIA TURBINATA, *Schlotheim*, sp. Pl. XXIX, figs. 1—16, and Pl. XXX, figs. 1—12.

- 1821. MURICITES TURBINATUS, *Schlotheim*. Petref., p. 145.
- 1827. BUCCINUM SPINOSUM, *Sowerby*. Min. Conch., vol. vi, p. 128, pl. dlxvi, fig. 4.
- 1827. TURRITELLA ABBREVIATA, *Sowerby*. Ibid., vol. vi, p. 125, pl. dlxvi, fig. 2.
- 1830. MELANOPSIS CORONATA, *Höninghaus*. Jahrb. f. Min., p. 231.
- 1832. TURRITELLA CORONATA, *Goldfuss*. De la Beeche's Handbook (German edition), p. 533.
- 1834. CERITHIUM ANTIQUM, *Steininger*. Mém. Soc. Géol. Fr., ser. 1, vol. i, p. 367.
- 1840. SCHIZOSTOMA TRICINCTA, *Münster*. Beitr., pt. 3, p. 87, pl. xv, fig. 14.

¹ 1841, Phillips, 'Pal. Foss.,' p. 98, pl. xxxvii, fig. 181.

² 1872, Kayser, 'Zeits. Deutch. Geol. Gesell.,' vol. xxiv, p. 673, pl. xxvi, fig. 3.

³ 1840, Münster, 'Beitr.,' pt. 3, p. 86, pl. xv, figs. 11 a, b.

1840. *BUCCINUM SPINOSUM*, *Sowerby*. Geol. Trans., ser. 2, vol. v, pt. 3, pl. lvii, figs. 24—27.
- ? 1841. *MURCHISONIA ANGULATA*, *Phillips*. Pal. Foss., p. 101, pl. xxxix, fig. 189.
1841. — *GEMINATA*, *Phillips*. Ibid., p. 102, pl. xxxix, fig. 190.
1841. — *BILINEATA* ? *Phillips*. Ibid., p. 102, pl. xxxix, fig. 191.
1841. — *SPINOSA*, *Phillips*. Ibid., p. 102, pl. xxxix, figs. 192 *a—c*.
1842. — *CORONATA*, *d'Archiac and de Verneuil*. Geol. Trans., ser. 2, vol. vi, pt. 2, p. 355, pl. xxxii, fig. 3.
1842. — *INTERMEDIA*, *d'Archiac and de Verneuil*. Ibid., p. 356, pl. xxxii, figs. 4, 5.
1842. — *ANGULATA*, *d'Archiac and de Verneuil*. Ibid., p. 356, pl. xxxii, figs. 6, 7.
1842. — *BILINEATA*, *d'Archiac and de Verneuil*. Ibid., p. 356, pl. xxxii, fig. 8.
1842. — *BIGRANULOSA*, *d'Archiac and de Verneuil*. Ibid., p. 357, pl. xxxii, figs. 9—11.
1842. — *BINODOSA*, *d'Archiac and de Verneuil*. Ibid., p. 357, pl. xxxii, fig. 12.
- ? 1842—4. — *VERNEUILIANA*, *de Koninck*. Desc. Anim. Foss., p. 414, pl. xxxviii, figs. 5 *a, b*.
1843. — *HERCYNICA*, *F. A. Römer*. Verst. Harzgeb., p. 29, pl. viii, fig. 4.
1844. — *LINEATA*, *Goldfuss*. } Petref. Germ., vol. iii, p. 23, pl.
1844. — *BILINEATA*, *Goldfuss*. } clxxii, figs. 1 *a—c*.
1844. — *INTERMEDIA*, *Goldfuss*. Ibid., vol. iii, p. 23, pl. clxxii, figs. 2 *a, b*.
1844. — *CORONATA*, *Goldfuss*. Ibid., vol. iii, p. 23, pl. clxxii, figs. 3 *a, b*.
1844. — *BINODOSA*, *Goldfuss*. Ibid., vol. iii, p. 24, pl. clxxii, fig. 4.
1844. — *ANGULATA*, *Goldfuss*. Ibid., vol. iii, p. 24, pl. clxxii, figs. 5 *a—c*.
1844. — *BILINEATA*, *F. Römer*. Rhein. Uebergangsgeb., p. 80.
- ? 1849. — *ANGLICA*, *d'Orbigny*. Prodrome, vol. i, p. 70.
1849. — *BIGRANULOSA*, *d'Orbigny*. Ibid., vol. i, p. 70.
1849. — *BINODOSA*, *d'Orbigny*. Ibid., vol. i, p. 70.
1849. — *ANTIQUA*, *d'Orbigny*. Ibid., vol. i, p. 70.
1849. — *GEMINATA*, *d'Orbigny*. Ibid., vol. i, p. 70.
1849. — *INTERMEDIA*, *d'Orbigny*. Ibid., vol. i, p. 70.
1849. — *HERCYNICA*, *d'Orbigny*. Ibid., vol. i, p. 70.
1848. — *BINODOSA*, *Bronn*. Index Palæont., p. 747.
1848. — *GEMMATA*, *Bronn*. Ibid., p. 747.
1848. — *HERCYNICA*, *Bronn*. Ibid., p. 747.
1848. — *TURBINATA*, *Bronn*. Ibid., p. 748.
- ? 1848. — *VERNEUILIANA*, *Bronn*. Ibid., p. 748.
1850. — *BISTRIATA*, *F. A. Römer*. Beitr., pt. 1, p. 37, pl. v, fig. 26.
1851. — *TURBINATA*, *Bronn*. Lethæa, 3rd ed., pt. 2, p. 461, pl. iii, fig. 16.

1851. MURCHISONIA BACHELIERI, *Rouault*. Bull. Soc. Géol. Fr., ser. 2, vol. viii, p. 384.
1852. — BILINEATA, *Quendst.* Handb. Petref., p. 425, pl. xxxiv, fig. 11.
1853. PLEUROTOMARIA ANGULATA, *Sandberger*. Verst. Rhein. Nassau, p. 204, pl. xxiv, figs. 19, 19 a.
1853. — NERINÆA, *Sandberger*. Ibid., p. 203, pl. xxiv, fig. 18.
1853. MURCHISONIA INTERMEDIA, *Steininger*. Geogn. Beschreib. Eifel., p. 46.
1853. — ANTIQUA, *Steininger*. Ibid., p. 46.
1854. — BIGRANULOSA, *Morris*. Catal. Brit. Foss., p. 258.
1854. — GEMINATA, *Morris*. Ibid., p. 259.
1854. — SPINOSA, *Morris*. Ibid., p. 259.
- ? 1860. PLEUROTOMARIA EXILIS, *Eichwald*. Lethæa Rossica, p. 1168, pl. xlv, fig. 13.
- ? 1861. MACROCHILUS DESIDERATA, *Hall*. Desc. N. Sp. Foss., p. 22.
- ? 1862. — — *Hall*. Fifteenth Rep. N. Y. State Cab. Nat. Hist., p. 50, pl. iv, fig. 12.
1867. MURCHISONIA ORNATA, *Trenkner*. Paläont. Novit., pt. 1, p. 9, pl. i, fig. 15.
- ? 1867. — COCKLEA, *Trenkner*. Ibid., p. 9, pl. i, fig. 16.
1876. — TURBINATA, *F. Römer*. Lethæa Pal., pl. xxxii, fig. 4.
- ? 1876. — VERNEUILIANA, *F. Römer*. Ibid., pl. xlv, fig. 12.
1876. — DELAGEI, *Munier-Chalmas*. Journ. Conch., ser. 2, vol. xvi, p. 104.
1877. — — *Delage*. Strat. Terr. Prim., Ille-et-Vilaine, p. 80.
- ? 1879. — DESIDERATA, *Hall*. Pal. N. Y., vol. v, pt. 2, p. 89, pl. xxi, figs. 1—3, 10.
1879. — INTERCEDENS, *Hall*. Ibid., vol. v, pt. 2, p. 92, pl. xxx, fig. 29.
1881. — BILINEATA, *Zittel*. Handbuch Palæozool., Band ii, p. 182, fig. 224 a.
1883. — INTERMEDIA, *Tryon*. Structural Conch., vol. ii, p. 319, pl. lxxxii, fig. 86.
1884. — HERCYNICA, *Clarke*. Neues Jahrb. f. Min., Beil.-Band iii, p. 345.
1884. — BILINEATA, *Clarke*. Ibid., Beil.-Band iii, p. 345.
1884. — ANGULATA, *Clarke*. Ibid., Beil.-Band iii, p. 345.
- ? 1884. — cf. TRICINCTA, *Clarke*. Ibid., Beil.-Band iii, p. 345.
- ? 1884. — OBTUSANGULA, *Lindström*. Sil. Gast. Gottland, p. 128, pl. xii, figs. 7, 13.
1885. — BIGRANULOSA, *Etheridge*, in Phillips' Manual of Conch., pl. ix, fig. 11.
1887. — BACHELIERI, *Æhlert*. Bull. Soc. d'Étude Sci. d'Angers, p. 15, pl. viii, figs. 2—2 b.
1887. — CHALMASI, *Æhlert*. Ibid., p. 16, pl. viii, figs. 3—3 b.
1887. — ANGULATA, *Tschernyschew*. Mém. Com. Géol. Russ., vol. iii, No. 3, p. 171, pl. v, fig. 14.
1887. — INTERMEDIA, *Tschernyschew*. Ibid., p. 171, pl. vi, figs. 12 a, b.
1887. — BILINEATA, *Fischer*. Manuel Conchyl., p. 847, pl. x, fig. 25.
1888. — BIGRANULOSA, *Etheridge*. Foss. Brit., vol. i, Pal., p. 164.
1888. — GEMINATA, *Etheridge*. Ibid., vol. i, Pal., p. 164.

1888. MURCHISONIA SPINOSA, *Etheridge*. Ibid., vol. i, Pal., p. 164.
 1883. — — — *Prestwich*. Geology, vol. ii, p. 79, pl. v, fig. 10.
 1889. PLEUROTOMARIA LATEVITTATA, *Koken*. Neues Jahrb. f. Min., Beil.-Band vi,
 p. 324, pl. x, fig. 12.
 1889. MURCHISONIA aff. BIGRANULOSA, *Koken*. Ibid., Beil.-Band vi, p. 367, pl.
 xiv, fig. 5.

Description.—Shell large, very variable, elevated, many-whorled, turritid, and frequently more or less coarsely tuberculated. Apex apparently rather sharp. Spire conical, more or less elongated, generally, but not always, far exceeding the body-whorl in height, coiled irregularly in about seven to ten volutions. Suture deep, acute, simple or frequently complicated by the ornament. Whorls swollen, angulated, variable in shape, generally bearing just below the suture a tuberculated ridge or row of tubercles, which are sometimes very large and nodulous, and about twelve to fourteen to the whorl, and having more rarely on the lower bend of the whorl another indistinct ridge or row of elongate tubercles. Sinus-band in the centre of the back, narrow, prominent, concave, bounded by two strong, sharp, lofty ridges. Growth-lines irregular, indistinct, moderately oblique, arching in a slightly sigmoidal curve back from the suture to the sinus-band, where they are recurved, and then sloping similarly forward on the lower part of the whorl. Mouth small, oblique, sub-ovate, bluntly and indistinctly pointed both above and below. Outer lip convex, deeply notched at the extremity of the sinus-band. Columella thickened, arched, rounded. Umbilicus absent, or occasionally present but very small. Shell-structure thin on the back of the whorls, thicker elsewhere.

Size.—A very large specimen, wanting the body-whorls, measures 70 mm. high by 27 mm. wide. Other specimens, with the body-whorls, measure respectively 70 mm. by 31 mm.; 57 mm. by 30 mm.; and 33 mm. by 22 mm.

Localities.—This species is very common at Chudleigh, and is well represented from that locality in most collections. From Wolborough there are two specimens in Mr. Vicary's collection, three in the Torquay Museum, one in the British Museum, and one in my Collection. In the Torquay Museum are three small specimens which may have come from Lummaton.

Remarks.—This shell is so variable that it is very difficult to give an exact description of it. If two of the extreme varieties were placed together without their connecting links, they would certainly be regarded as belonging to distinct species if not to distinct genera. Nevertheless, when a large number are examined together, it is at once seen that hardly two specimens are exactly alike, and that extreme varieties can be united in series of almost imperceptible links, so that it is impossible to find a dividing line between them. Moreover, sometimes the shape, ornament, and coiling change their character in different parts of the same shell. This is strikingly seen in one of Mr. Vicary's specimens (Pl. XXX, fig. 12),

in which the first seven whorls exactly correspond with Goldfuss's figure of the variety *M. intermedia*, while the other two whorls change from the short, rounded, nodulous, to the acutely triangular, smooth style, and have very narrow sinus-bands, so that they are much beyond the extremes of his figures of the varieties *M. bilineata* and *M. angulata*. Another of Mr. Vicary's specimens has its whorls generally smooth, but they occasionally become tuberculous for a short distance.

The coiling of the spire is frequently irregular, so that its contour becomes slanting or unsymmetrical, convex or concave. Specimens also differ very greatly in elevation, and in the size of the body-whorl, some having it higher and more capacious than the rest of the spire, while in others it is less than a quarter of the total height. Again the shape of the section of the whorls and the amount of tuberculation is extremely variable, but, as observed above, these points sometimes change so much in the same specimen that it is easy to see that they are not specifically important. In spite of all these differences there is so much character in the species that, except perhaps in one or two cases, it is very easy to define its bounds. The only other Devonshire species which approaches it is *M. Vicariana*, but that shell shows several clear distinctions, and I have seen no passage specimens between them.

On the other hand there is a recognisable amount of centering around certain shapes, a few of which are enumerated below; but in all probability these were not hereditary varieties, but only common accidental shapes of the shell.

1. Group *spinosa*. Shell often very large, generally much elevated. Upper row of nodules few and very coarse; lower row sometimes indistinct, sometimes like the upper row. Whorls subquadrate. Pl. XXIX, figs. 1—10.

Cf. *M. spinosa*, Sowerby, and Phillips (pars), *M. coronata*, *bigranulosa*, and *binodosa*, d'Archiac and de Verneuil.

2. Group *curta*. Shell short, body-whorl generally longer than the spire. Upper row of nodules few and very coarse; lower row absent. Whorls subglobose. Pl. XXIX, figs. 14—16.

Cf. *M. spinosa*, Phillips (pars).

3. Group *intermedia*. Shell rather large, regular, elevated, conical. Upper row of nodules small, and numerous, and indistinct. Whorls subquadrate. Pl. XXX, figs. 1—4.

Cf. *M. bilineata*? Phillips; *M. intermedia*, d'Archiac and de Verneuil.

4. Group *angulata*. Shell elongate, irregularly coiled. Whorls triangular, not nodulous. Sinus-band prominent, strongly ridged, situate at the widest and central line of the whorl to which the sides slope concavely above and below. Pl. XXX, figs. 5—10.

Cf. *M. angulata* and *geminata*, Phillips; *M. angulata*, d'Archiac and de Verneuil; *M. angulata* (pars) and *nerinæa*, Sandberger.

In the British Museum is a specimen which is supposed to be Sowerby's type of his *B. spinosum* from Bradley. It evidently belongs to this species, as an interesting variety, and may be compared with Pl. XXIX, figs. 9 and 10, but differs in its nodules, which are fewer and more defined. The matrix is very like that of the Chudleigh shells, but the material of the shell itself is crystalline. I could well imagine that it came from Chudleigh.

The originals of two of Phillips's figures (192 *b* and *c*) of *M. spinosa* are in the Museum of Practical Geology; one of these belongs to the group *curta*, the other is intermediate between *curta* and *spinosa*.

The specimen described by Phillips as *Murchisonia geminata* is in the Museum of Practical Geology, and a comparison of it with other specimens proves it to be only a variety of the present shell with more angulated whorls and more numerous and finer nodules than usual. It would lie between the groups *intermedia* and *angulata*.

M. tricineta, Münster,¹ agrees with some of our examples, and evidently must be referred to the same species (cf. Pl. XXX, fig. 11). It is a very imperfect example of a young shell.

M. Hercynica, F. A. Römer, seems only to differ from some of our smooth varieties by having somewhat more pronounced spiral ridges. In Römer's figure these seem indistinct, and not very different from what is seen in some of the English shells (cf. Pl. XXX, fig. 6), and, therefore, are probably not of specific value. Clarke regards *M. conula*, de Koninck,¹ as possibly identical with it, but that shell is certainly different from *M. turbinata*.

In the Battersby Collection of the Torquay Museum is a badly preserved shell which is just like *Pleurotomaria nerinæa*, Sandberger. This is much more elongate than usual, but not quite as much so as is Sandberger's figure. The only markings seen are two foliaceous ridges, bounding a wide sinus-band, which is situated rather low on the whorl. This specimen is certainly a variety of *M. turbinata*, and hence it follows that Sandberger's type must also belong to it, and, therefore, his name becomes a synonym.

In the same Museum are three small specimens which exactly agree with one of the figures given by Sandberger of his *Pl. angulata*. They appear to be small forms of our group *angulata*, and hence are connected by Mr. Vicary's shell (Pl. XXX, fig. 12) with the group *intermedia*. Sandberger identifies his shell with *M. angulata*, Phillips, of the Pal. Foss.; but not with his *Rostellaria angulata*,² of the Geol. of Yorkshire. A comparison of these two figures and of that given by de Koninck in his 'Desc. Anim. Foss.' certainly gives every reason for regarding the Carboniferous species as distinct. The second or shorter of Sandberger's two

¹ 1883, de Koninck, 'Ann. Mus. Roy. H. N. Belg.,' vol. viii, pt. 4, p. 17, pl. xxxiv, figs. 9, 10.

² 1836, Phillips, 'Geol. Yorks.,' vol. ii, p. 230, pl. xvi, fig. 16.

figures, if it belongs to the same species as the other, represents a variety which I have not met with among the English specimens.

Prof. F. Römer¹ appears to have been the first to point the extreme variability of the present shell. After the examination of a large number of examples he united the *M. bilineata*, *M. intermedia*, *M. coronata*, and *M. bigranulosa*, as well as more doubtfully the *M. binodosa*, and *M. angulata*, of Goldfuss and of d'Archiac and de Verneuil.

De Koninck, in his earlier work, figured a fossil from the Carboniferous of Belgium under the name of *M. Verneuiliana*,² which he identified with *M. angulata*, d'Arch. and de Verneuil, but separated from *M. angulata*, Phillips. This seems exactly similar to some specimens of the present shell, which in that case would have to be regarded as reaching into the Carboniferous. In his later work,³ however, de Koninck retracts his identification; and in the enlarged figure, which he there gives, the minor ornament is very different, and, therefore, at least as amended, his species is distinct. *M. angulata*, de Koninck,⁴ though identified by him with Phillips' Devonian shell, and *Pleurotomaria angulata*, de Koninck,⁵ are two totally different species. There are, however, numerous specimens labelled *M. angulata* and *M. Verneuiliana* in the British Museum from the Mid. Dev. of Petigny, Belgium, which while they agree with our var. *angulata*, Pl. XXX, figs. 8—10, vary very little, and show that in Belgium at all events it is a fixed variety, if not even an established species.

I have not found any specimens agreeing with *M. bilineata*, d'Archiac and de Verneuil, among the English shells. It appears, however, to come very close to one of the figures of his *M. intermedia* and to lie between our groups *intermedia* and *angulata*, differing from the first in having no tubercles, and from the latter in having less angulated whorls. I think that it most probably belongs to the same species. It certainly has a somewhat distinct appearance owing to the breadth of its whorls, but it may in this respect be compared with the specimen figured at Pl. XXIX, fig. 8. *M. bilineata*, Sandberger,⁶ is a different shell, with evenly convex whorls and a low sinus-band, and probably belongs to *M. loxonemoides*, n. sp.; Goldfuss figures three specimens under the name of *M. bilineata* which bridge over the difference between d'Archiac and de Verneuil's figure and some of our specimens (*e. g.* Pl. XXX, figs. 8 and 12); and a number of foreign specimens are in the British Museum by which a perfect chain can be arranged from even more aberrant specimens than that figured by d'Archiac and de Verneuil, and the ordinary nodulated varieties of the shell.

¹ 1844, F. Römer, 'Rhein. Uebergangsgeb.,' p. 80.

² 1842-44, de Koninck, 'Desc. Anim. Foss.,' p. 414, pl. xxxviii, figs. 5 *a*, *b*.

³ 1883, de Koninck, 'Ann. Mus. Roy. H. N. Belg.,' vol. viii, pt. 4, p. 25, pl. xxxiv, figs. 35—37.

⁴ 1842-44, de Koninck, 'Desc. Anim. Foss.,' p. 412, pl. xxxviii, figs. 8 *a*—*c*.

⁵ *Ibid.*, p. 369, pl. xxxvii, figs. 2 *a*—*e*.

⁶ 1853, Sandberger, 'Verst. Rhein. Nassau,' p. 204, pl. xxiv, fig. 17.

Pl. exilis, Eichwald, is a small shell which differs in having eight rounded whorls with a very broad sinus-band, but is otherwise very similar to this species, to which it is just possible that it may belong.

M. Bachelieri, Rouault, seems from Ehlert's description to be so similar that I believe it to be a synonym. The only difference I can see, is the rather greater convexity of the upper part of the whorls than in most English examples. *M. Chalmasi*, Ehlert, is identical with some of our varieties.

I am, on the whole, inclined to regard *M. desiderata*, Hall, as a plain form of the European shell. It comes very close to Goldfuss' figure of *M. bilineata*, but neither it nor any of the other American shells show any signs of sutural nodulation, and the thin transverse striæ seem finer and more regular. It appears to be at least the American representative form.

M. intercedens, Hall, is another American so-called species which I cannot distinguish from some of the smooth examples of the British shell.

M. obtusangula, Lindström, seems so similar in shape that it may be the same species. Possibly its sinus-band is rather more elevated.

Schlothheim's original description of *M. turbinata* is very vague, and is unaccompanied by a figure. Bronn appears to have been the first to recognise its identity with some of the forms (*M. intermedia*, *M. bilineata*, *M. coronata*, *M. bigranulosa*) described by Goldfuss, and d'Archiac and de Verneuil. He still separated it from *M. spinosa* which he placed under the name *M. binodosa* d'Archiac, but as we have seen above, there is not the slightest doubt of their identity. The shell was figured under the name *M. turbinata* first by Bronn in 1851 and afterwards by F. Römer in 1876, and there can be no question that this is the designation which it ought to bear.

Affinities.—*M. Marsi*, Ehlert,¹ differs in having a fine line bisecting a broad sinus-band; and *M. Lebesconti*, Ehlert,² and *M. Davidsoni*, Ehlert,³ differ in having very convex whorls and flat sinus-bands. It is very possible that the two former belong to a single species; but I do not think they are varieties of the present shell, as their broad and sometimes bisected sinus-bands, combined with broad globose whorls, are features which do not characterise any of the varieties of *M. turbinata* which I have had the opportunity of examining.

The figured specimen of Phillips' original Carboniferous *M. angulata*⁴ in the British Museum is so poor as to be indescribable, but better specimens in the same museum show that it is quite distinct. It has a very highly keeled sinus-band situated very low on the whorls, and very numerous fine spiral striæ.

¹ 1887, Ehlert, 'Bull. Soc. d'Etud. Sci. d'Angers,' p. 17, pl. viii, figs. 1, 1 a. b.

² Ibid., p. 18, pl. vii, figs. 3, 3 a, 3 b.

³ Ibid., p. 20, pl. vii, figs. 4, 4 a—d.

⁴ 1836, Phillips, 'Geol. Yorks.,' vol. ii, p. 230, pl. xvi, fig. 16.

In *M. cingulata*, d'Archiac¹ (not Hisinger), and *M. Loesseni*, Kayser,² the sinus-band forms a very elevated broad and flat ridge along the centre of the whorl.

M. spirata, Goldfuss,³ is very similar to some of the smooth forms of our species, but I do not think that it is likely to be a variety of it, as it differs in the possession of several coarse spiral ridges below the sinus-band.

M. moniliformis, Lindström,⁴ and *M. Hebe*, Billings,⁵ are distinguished by having regularly globose or convex whorls.

2. MURCHISONIA VICARIANA, n. sp. Plate XXX, figs. 13—15.

Description.—Shell of moderate size, very elongate and subulate, turrited and finely tuberculated. Apex sharp. Spire elongated, irregularly coiled, and sometimes rather deflected, of eight or nine volutions. Suture deep, obtuse. Whorls slightly convex, more or less flattened on the back; curving round gently below to form a sloping oblique base. Sinus-band median, very prominent, narrow, consisting of an almost linear groove between two rounded ridges. Ornament consisting of two low, beaded, rounded ridges between the suture and the sinus-band, separated by similar grooves, and two or sometimes three similar ridges below the sinus-band, of which only one is visible on the upper whorls; the whole crossed by numerous, close, sharp, lamellar, very irregular, undulating striæ or growth-lines, which trend rather backwards above, and forwards below the sinus-band, over which they are gently recurved. Mouth elongate, pointed above, produced sub-angulated and slightly excavate below. Outer lip gently convex. Inner lip callous, diffuse. Columella long, straight, thickened. Umbilicus minute or obliterated. Shell-structure thick except on the back of the whorls.

Size.—Height 40 mm., width 15 mm.

Locality.—Chudleigh. There are five specimens in Mr. Vicary's Collection.

Remarks.—These fossils are closely allied to *M. turbinata*, Schlot., and I am in some doubt whether they are more than a variety of that very variable shell. They seem, however, to be separated by several constant differences, and there is little or no indication of any passage between them and its various forms.

¹ 1845, Murchison, de Verneuil, and de Keyserling, 'Geol. Russ.,' vol. ii, p. 339, pl. xxii, figs. 7 a, b.

² 1889, Kayser, 'Abhandl. König. Preuss. Geol. Landes.,' Neue Folge, Heft 1, p. 15, pl. viii, fig. 9.

³ 1844, Goldf., 'Petref. Germ.,' vol. iii, p. 24, pl. clxxii, figs. 6 a, b.

⁴ 1884, Lindström, 'Sil. Gast. Gottland,' p. 128, pl. xii, figs. 5, 6.

⁵ 1874, Billings, 'Palæozoic Fossils,' vol. ii, pt. 1, p. 57, fig. 28, pl. v, fig. 6.

Though they themselves show some amount of variability they present a very close general resemblance to each other; especially in the very narrow median sinus-band, the two ridges above it and the two or three below it, the sharp lamellar growth-striæ, the fine indistinct tuberculation, the elongate mouth, and the general contour of the spire. Specimens of *M. turbinata* may certainly be found which agree with them in one or two of these particulars, but in every case they are very distinguishable in others. The number and shape of the spiral ridges, both above and below the sinus-band, are especially distinctive. In none of the specimens of *M. turbinata* is there more than one ridge above it. In one of the present specimens it is true that the lower of the two ridges is much smaller than in the other, but even in this case it is constant and well defined. I therefore think that there is sufficient grounds for regarding it as a distinct species, although, if passage forms were found, this opinion might have to be modified.

3. MURCHISONIA TREPOMENA, n. sp. Pl. XXX, figs. 16, 16 a.

1841. MURCHISONIA TRICINCTA, *Phillips* (not *Münster*). Pal. Foss., p. 139,
pl. lx, fig. 190.*
1842. — — — *d'Arch. and de Vern.* Geol. Trans., ser. 2, vol. vi,
pt. 2, p. 358, pl. xxxii, figs. 13, 13 a.
1852. PLEUROTOMARIA TRILINEATA, *Sandberger* (not *Goldfuss*). Verst. Rhein.
Nassau, p. 202, pl. xxiv, figs. 16,
16 a.
1854. MURCHISONIA TRICINCTA, *Morris*. Catal. Brit. Foss., p. 259.
1888. — — — *Etheridge*. Foss. Brit., vol. i, Pal., p. 164.

Description.—Shell very elongate, subturrited, regular. Apex sharp. Spire very elongate and subulate, of twelve or fourteen, narrow, convex, very slowly increasing whorls. Suture deep, acute, facing upwards. Whorls more convex below than above, bearing at about two thirds the way down a narrow, concave sinus-band, bounded by two sharpish ridges. Surface above and below the sinus-band marked with two or three indistinct spiral ridges, of which the two most prominent are sutural and finely beaded; the whole crossed by fine distant growth-striæ trending backwards to, and forwards from, the sinus-band. Mouth small, wide, subquadrate. Inner lip short, straight. Outer lip notched at the extremity of the sinus-band.

Size.—Height, 32 mm.; width, 11 mm.

Locality.—Wolborough. There are seven specimens in the Godwin-Austen Collection in the Museum of Practical Geology, four in Mr. Vicary's Collection, one in the British Museum, and two in the Woodwardian Museum.

Remarks.—One of the specimens in the Godwin-Austen Collection appears to

be the original of Phillips' figure of *M. tricincta* (fig. 190*), but does not show such an elaborate ornamentation as is represented in his figure. It is a sufficiently distinct species, and is characterised by its numerous and narrow whorls, its low-set, narrow sinus-band, and slight indistinct spiral ridges. It was identified by Phillips with *Schizostoma tricinctum*, Münster,¹ but the above-mentioned points all separate it from that shell, which in fact is, in all probability, only a variety of *Murchisonia turbinata*, Schlot. It therefore becomes needful to find another name for the species.

It agrees accurately with *Pleurotomaria trilineata*, Sandb., but the name *M. trilineata* was before used by Goldfuss² for quite a different shell with much shorter spire and smooth whorls.

Affinities.—*Pleurotomaria dentalo-lineata*, Sand.,³ differs in having reticulated striæ above the sinus-band, in having a coarsely and convexly-barred sinus-band situated lower on the whorls, in being sinistral, and having more quickly-increasing whorls. *Pl. bilineata*, Sandberger,⁴ not d'Archiac and de Verneuil, has broader whorls and a lower sinus-band.

Murchisonia quadricincta, Trenkner,⁵ is very similar, and may perhaps be the same species. According to his figure it has evenly convex whorls with one or two spiral ridges just below the suture, and three others on the lower part of the whorl.

From *M. loxonemoides* it differs in several particulars as mentioned under that species, *e. g.* its narrow whorls, coarser and more distant transverse striæ, and more median sinus-band.

M. conula, de Koninck,⁶ has four strong keels on its whorls, and the sinus-band is median.

I have been in much doubt whether *M. Hercynica*, F. A. Römer,⁷ is the same as this shell, with which Clarke⁸ is inclined to unite it, or with *M. turbinata*, Schlotheim. Römer's figure is very indistinct and his description might apply to either. After repeated examinations I am inclined to think that its shape and the median position of its sinus-band points to its identity with the latter species rather than with the present.

¹ 1840, Münster, 'Beitz.,' pt. 3, p. 87, pl. xv, figs. 14 *a*, *b*.

² 1844, Goldf., 'Petref.,' vol. iii, p. 25, pl. clxxii, figs. 8, 8 *a*.

³ 1853, Sandberger, 'Verst. Rhein. Nassau,' p. 201, pl. xxiv, figs. 14, 14 *bis*, 14 *a*.

⁴ Ibid., p. 204, pl. xxiv, fig. 17.

⁵ 1868, Trenkner, 'Paläont. Novit.,' pt. 2, p. 22, pl. vii, fig. 10.

⁶ 1883, de Koninck, 'Ann. Mus. Roy. H. N. Belg.,' vol. viii, pt. 4, p. 17, pl. xxxiv, figs. 9, 10.

⁷ 1843, F. A. Römer, 'Verst. Harzgeb.,' p. 29, pl. viii, fig. 2.

⁸ 1884, Clarke, 'Neues Jahrb. f. Min.,' Beil.-Band iii, p. 345.

4. MURCHISONIA LOXONEMOIDES, n. sp. Pl. XXX, figs. 17, 18, 18 a.

1853. PLEUROTOMARIA BILINEATA, Sandberger (not d'Archiac and de Verneuil).
Verst. Rhein. Nassau, p. 204, pl. xxiv,
fig. 17.

Description.—Shell very elongate, large, acuminate, coiled in more than eight rather broad whorls. Apex probably acute. Spire regularly and slowly increasing. Suture rather shallow and obtuse. Whorls rather broad, moderately and regularly convex, the widest point being about three-quarters the way down from the suture. Sinus-band situated on the widest point, rather narrow, prominent, bounded by two large rounded ridges, of which the upper is the largest. Ornament consisting of two small spiral ridges below the sinus-band, and two or three slight indications of spiral lines above it; the whole crossed by numerous, very fine, regular, almost microscopic, transverse lines, arching gently backwards on the upper part of the whorls, recurved on the suture, and running obliquely forward below it. Mouth unseen. Shell-structure thin. No umbilicus.

Size.—Height 50 mm., width 22 mm. (specimen defective).

Localities.—Three specimens from Wolborough, and one probably from Lummaton, are in the Torquay Museum.

Remarks.—This species is characterised by its regular shape, rather broad and evenly convex whorls, and delicate non-tuberculate ornament. It presents so strong a general resemblance to *Loxonema reticulatum*, Phillips, that specimens which want the surface may easily be confounded, but of course when any of the ornament can be seen the shells are at once distinguishable.

M. bilineata, Sandberger (not Goldfuss), very closely resembles this shell. Its whorls are somewhat narrower, and Sandberger mentions only a single spiral ridge below the sinus-band which is not shown in the figure, but the position of the sinus-band is identical, and on the whole it seems probable that it is the same species.

Affinities.—The points above mentioned remove it so far from all the varieties of *M. turbinata*, Schlotheim, sp., that it evidently is specifically distinct. It approaches *M. trepomena* more nearly; and the ornamentation is so similar that possibly it may prove to be no more than a variety of it; but as that species, unlike *M. turbinata*, Schlotheim, seems to vary very little, there appears more reason for regarding it as distinct. The whorls in this shell are much broader and more convex, the sinus-band is decidedly lower on the whorls, and the ornamentation is coarser.

Turritella Ponti, Goldfuss,¹ approaches this shell closely in ornament, but the

¹ 1844, Goldfuss, 'Petref. Germ.,' vol. iii, p. 104, pl. cxvii, figs. 2 a, b.

transverse striæ on the upper part of the whorls are coarser, the four carinæ on the lower part are larger and more separated, and the whorls are almost as broad as high. Goldfuss does not recognise any sinus-band, but the similarity in other respects is so great that I am much under the impression that it existed, and that it is at least a kindred species to the present form.

Pleurotomaria insignis, Eichwald,¹ also seems rather similar, but the transverse striæ are still more deeply deflected, and the sinus-band is not so low down and is very indistinct.

Pl. nitida, Eichwald,² has a flat sinus-band, and narrower and much more numerous whorls.

5. MURCHISONIA MARGARITA, n. sp. Pl. XXX, figs. 19, 20, 20 a.

Description.—Shell small, extremely elongate, turrit, of nine to fifteen whorls. Apex very sharp, sometimes produced, and twisted asymmetrically for the last three or four whorls. Spire very elongate and subulate, with narrow, triangular, slowly increasing whorls. Suture deep, linear, facing upwards. Whorls much exposed, bluntly triangular in section, with a strong, microscopically tuberculated hem or rounded rim immediately below the suture, followed by an indistinct groove, from which the line of contour spreads in a concave curve to the central and widest part of the whorl, which is sharply rounded, and then sinks in a similar curve to the lowest part, which bears a similar indistinct hem. Sinus-band central, rather broad, defined by minute raised threads outside linear grooves, within which is a row of close round tubercles forming the raised centre of the band. Ornamentation consisting of six or seven very minute spiral threads both above and below the sinus-band, and similar transverse threads sloping backwards to, and forwards from, the sinus-band. Mouth short, oblique, and wide. Outer lip deeply and widely notched; inner lip long. No umbilicus.

Size.—Length of a specimen of about fifteen whorls, 21 mm.; width, 5 mm.

Locality.—Chudleigh. Two specimens are in the Woodwardian Museum.

Remarks.—The larger of these two specimens has rather narrower whorls than the other, and is a much more subulate shell, with fifteen whorls remaining. Some of the whorls of the nucleus are strangely twisted and elongated, and, though this might be accounted for by a crushing of the fossil, it has more the appearance of being a natural though, of course, accidental feature of the shell. The other specimen has only nine or ten whorls including the body-whorl. However, they

¹ 1860, Eichwald, 'Lethæa Rossica,' p. 1165, pl. xliii, fig. 1.

² Ibid., p. 1179, pl. xliii, fig. 2.

undoubtedly belong to the same species, and are characterised by the central convex sinus-band, the peculiarly arched sides, and the numerous spiral striæ.

Affinities.—From *M. turbinata*, Schlotheim, this species is widely separated, and evidently is formed on a very different plan. *M. trepomena* approaches it more nearly; from Phillips' original figure it might perhaps be supposed to be identical, but his description and an examination of the type specimen show that it is really quite distinct. In that species the sinus-band is not central but close to the lower suture, there were very few spiral threads in the ornamentation, and the contour of the whorls is nearly evenly conical.

It approaches the Carboniferous *M. angulata*, Phillips, sp.,¹ but, as seen by a comparison of Phillips' specimens in the British Museum, in that shell the whorls are broader, the spiral striæ are smaller and more numerous, and the sinus-band does not seem so coarsely nodulated.

6. MURCHISONIA ? OBESA, n. sp. Pl. XXX, fig. 21.

Description.—Shell small, conical, turritid, moderately elongated, of six or seven narrow, regularly and slowly increasing volutions. Apex acute. Suture rather deep and broad. Whorls very narrow, gently and evenly convex, slightly flattened on the back. Sinus-band narrow, flat, situated about three-quarters down on the whorl, and below its greatest width. Body-whorl small, similar to the other whorls of the spire. Ornament consisting of very numerous, delicate, direct transverse striæ, apparently tending slightly backwards just above the sinus-band and gently curving on it, crossed and decussated by numerous similar spiral striæ, which seem larger and coarser on the lower part of the whorls.

Size.—Height and width about 15 mm.

Locality.—Wolborough. There are two specimens in Mr. Vicary's Collection.

Remarks.—These specimens are so much worn that the ornament and other characters of the shell cannot be fully made out. Whether the band on the lower part of the whorl is a true sinus-band is not absolutely certain, but as far as can be seen from the state of the ornament it has every appearance of being so.

In general shape these little fossils are very different from any other Gasteropod occurring in the beds we are now reviewing, and I have not noticed any foreign species with which they appear to correspond.

¹ 1836, Phillips, 'Geol. Yorks.,' vol. ii, p. 230, pl. xvi, fig. 16.

3. Genus—ODONTOMARIA, *F. Römer*, 1876.

This genus was formed for the reception of a Devonian shell in the shape of an unrolled *Pleurotomaria*, with which Prof. Römer regards it as closely allied. At first sight our specimens seem very like a *Dentalium* or even a *Serpula*, to the latter of which some specimens of the following species were formerly referred by Sandberger. A close examination, however, seems to bear out Prof. Römer's view, which was probably based upon the observation of better preserved specimens than those which we have seen.

1. ODONTOMARIA SEMIPLICATA, *Sandberger*, sp. Pl. XXXI, figs. 2, 2 *a*.

1850. SERPULA SEMIPLICATA, *Sandberger*. Verst. Rhein. Nassau, p. 38, pl. iii, figs. 6, 6 *a*, 6 *b*.

Description.—Shell tubular, slightly arched but not spirally coiled, twisted, slowly attenuating at the rate of 1 mm. in width to 9 mm. in length. Whorl or tube rather spirally twisted, so that the marks which start on the back or external side are, in the course of growth, gradually carried upwards through a quarter of a circle. Section of the whorl nearly circular or oval, slightly flattened on the sinus-band, and on a broader surface on each side of it. Sinus-band broad, flat, bounded by low rounded ridges, situated on the centre of the outer surface of the tube. Ornament consisting of two similar slight ridges bounding the flattened surface on each side of the sinus-band; the whole crossed by very indistinct growth-lines which appear to cross the sinus-band horizontally, and to be directed forward on each side of it.

Size.—Length 60 mm. Diameters of section at widest part 11 mm. and 9 mm.

Locality.—Wolborough. There is a specimen in the Torquay Museum, another in the Museum of Practical Geology, a third in Mr. Vicary's Collection, and a fourth in Mr. Champenowne's Collection.

Remarks.—These curious shells agree exactly with the fossil described by Sandberger from the Stringocephalus-Limestone of Villmar. Their surface is in every case almost completely obliterated. They show great regularity in their general shape, except that the amount of curvatures seems greater in some parts of the tube than in others, and that the section of the whorl is in some cases circular and in other cases oval.

Affinities.—The present species presents great resemblance to the type species

of the genus, *Odontomaria elephantina*, which is figured and slightly described by Dr. F. Römer,¹ and which differs from it in its section being roughly octagonal instead of being oval. Hence, as far as can be judged from Römer's figure, it appears to be specifically distinct, though evidently very closely allied.

X. *Family*—BELLEROPHONTIDÆ, *M'Coy*, 1852.

1. *Genus*—BELLEROPHON, *Montfort*, 1808.

The zoological position of this group of palæozoic shells has been often altered. They were first supposed to belong to the *Cephalopoda*, then to the *Heteropoda*, but now they are generally placed low down among the *Gasteropoda*, being regarded as horizontally symmetrical shells akin to *Pleurotomaria*. They extend from the Cambrian throughout the Palæozoic period, and have been found in these strata in almost every part of the world.

1. BELLEROPHON LINEATUS, *Goldfuss* MS. Pl. XXXI, figs. 3—6.

- ? 1781. Nautilit sans cloisons, *de Hüpsch*. *Naturg. der Neiderdents*, p. 27, pl. iii, fig. 22.
1826. BELLEROPHON STRIATUS, *de Ferussac*. In d'Orbigny, *Tabl. Cephal.*; *Feru. Bull. (Sci. Nat.)*, vol. ix, p. 245.
1826. — — — *d'Orbigny et de Ferussac*. *Ann. Sci. Nat.*, vol. vii, p. 140.
1828. — — — *Keferstein*. *Teutschland*, Band vi, p. 27.
1832. — — ? *Goldfuss*. *De la Beche's Handbook*, German ed., p. 534.
1832. — — — *UNDULATUS*, *Goldfuss*. *Ibid.*, p. 534.
1834. — — — *STRIATUS*, *Keferstein*. *Nat. der Erdk.*, pt. 2, p. 430.
1834. — — — *UNDULATUS*, *Keferstein*. *Ibid.*, p. 430.
1835. — — — *STRIATUS*, *Bronn*. *Lethæa*, p. 96, pl. i, figs. 11 *a—c*.
1840. — — — *LINEATUS*, *Goldfuss*, MS. *De Ferussac et d'Orbigny, Hist. Nat. Ceph.*, p. 192.
1840. — — — *STRIATUS*, *de Ferussac*. *De Ferussac et d'Orbigny, Hist. Nat. Ceph.*, p. 192 (*Bellerophon*), pl. i, fig. 11; pl. iii, figs. 11—17; pl. iv, figs. 1—5, and pl. vii, figs. 4, 5.
- ? 1840. — — — *SOWERBYI*, *de Ferussac et d'Orbigny*. *Hist. Nat. Ceph.*, p. 202, (*Bellerophon*) pl. v, figs. 19—23.
1841. — — — *STRIATUS*, *Phillips*. *Pal. Foss.*, p. 106, pl. xl, figs. 198 *a, b*.

¹ 1876, F. Römer, '*Leth. Pal.*,' pl. xxix, figs. 10 *a, b*.

1842. *BELLEROPHON STRIATUS*, *d'Archiac and de Verneuil*. Geol. Trans., ser. 2, vol. vi, pt. 2, pp. 353 and 389, pl. xxviii, fig. 6.
1843. — — — — — *?, F. A. Römer*. Verst. Harzgeb., p. 32, pl. ix, figs. 4 *a*, *b*.
1848. — — — — — *Bronn*. Index Palæont., p. 164.
1849. — — — — — *d'Orbigny*. Prodrome, vol. i, p. 72.
- ? 1849. — — — — — *SOWERBYI*, *d'Orbigny*. Prodrome, vol. i, p. 126.
1850. — — — — — *STRIATUS*, *F. A. Römer*. Beitr., pt. 1, p. 33.
1851. — — — — — *Bronn*. Lethæa, 3rd edit., pt. 2, p. 442, pl. i, figs. 11 *a—c*, and pl. iii¹, figs. 19 *a*, *b*.
1853. — — — — — *LINEATUS*, *Sandberger*. Verst. Rhein. Nassau, p. 179, pl. xxii, figs. 5, 5 *a—h*.
1854. — — — — — *STRIATUS*, *Morris*. Catal. Brit. Foss., p. 288.
- ? 1854. — — — — — *SOWERBYI*, *Morris*. Ibid., p. 288.
1855. — — — — — *STRIATUS*, *M'Coy*. Synopsis Brit. Pal. Rocks, p. 400.
1861. — — — — — *PELOPS*, *Hall*. Descr. New Sp. Fossils, p. 28.
1862. — — — — — — — Fifteenth Report N. Y. State Cab. Nat. Hist., p. 56.
1869. — — — — — *LINEATUS*?, *Zeuschner*. Zeitsch. Deutsch. Geol. Gesell., vol. xxi, p. 267.
- ? 1871. — — — — — *PROPINQUUS*, *Meek*. Proc. Acad. Nat. Sci. Phil., p. 78.
- ? 1873. — — — — — — — Geol. Surv. Ohio, Pal., vol. i, p. 226, pl. xx, figs. 4 *a*, *b*.
1876. — — — — — *STRIATUS*, *F. Römer*. Lethæa Pal., pl. xxxii, fig. 9.
1879. — — — — — *PELOPS*, *Hall*. Pal. N. Y., vol. v, pt. 2, p. 95, pl. xxii, figs. 7—13; pl. xxvi, fig. 1.
- ? 1883. — — — — — *MEEKI*, *de Koninck*. Ann. Mus. Roy. H. N. Belg., vol. viii, pt. 4, p. 138, pl. xlii *bis*, figs. 24—26.
- ? 1883. — — — — — *AFFINIS*, *de Koninck*. Ibid., p. 138, pl. xlii *bis*, figs. 18—20.
1883. — — — — — *STRIATUS*, *Tryon*. Structural Conch., vol. ii, p. 322, pl. lxxxii, fig. 95.
1884. — — — — — *STRIATUS*?, *Clarke*. Neues Jahrb. f. Min., Beil.-Band iii, p. 347.
- ? 1887. — — — — — *SOWERBYI*, *Fischer*. Manuel Conchyl., p. 853, fig. 601.
1888. — — — — — — — *Etheridge*. Foss. Brit., vol. i, Pal., p. 165.
- ? 1888. — — — — — — — Ibid., p. 293.
1889. — — — — — *PELOPS*, *Barrois*. Faun. Calc. d'Ebray, p. 210, pl. xv, figs. 14 *a*, *b*.

Description.—Shell of median size, involute, horizontally symmetrical. Spire and umbilicus deep, rather open. Whorls rising from the suture and curving very rapidly round to the back, which is rounded, but rather obliquely flattened above and below, and meets in the centre in a small prominent squared keel. Keel bounded by very fine threads. Ornament consisting of delicate, sharp, distant, transverse ridges, much recurved on the keel, and proceeding from it at first nearly perpendicularly on each side, but bending obliquely forward and occasionally coalescing as they approach the suture; these ridges in some specimens com-

plicated by finer ones which tend to arrange themselves in groups. Mouth not preserved in the English specimens, but showing a callosity on its inner sides.

Size.—About 18 mm. in height; 20 mm. in width.

Localities.—There are four specimens from Lummaton in my Collection, three others probably from the same locality in the Torquay Museum, one from Barton and four from Wolborough in the Museum of Practical Geology, and one from Chudleigh in Mr. Vicary's Collection.

Remarks.—This species seems to be liable to very considerable variation both in shape and in ornament. Generally speaking it appears very globose, but the specimens figured by Phillips and some others are decidedly broader and flatter. The ornamentation is very definite on some of our specimens, but in others it is much more indistinct, and seems somewhat changed in character, the striæ being more numerous, oblique, close, and arranged in groups, and the keel seeming smaller and more rounded. I was at first inclined to regard these points as indicating a specific distinction, but further examination leads me to believe that they are partly due to crushing and deterioration during fossilization, and partly to individual variation. Thus, even in the most typical specimens with clear cut distant striæ, signs of other indistinct lines may be observed under a lens; and in other specimens the development of these secondary lines may be traced until they are seen to become similar to the original striæ. Moreover in some specimens these original striæ are considerably coarser and more distant than in others. While in the main the striæ are uniform, there are some slight indications of inequalities which might indicate a tendency to undulations in an older stage of growth than that of any of our specimens, so that then they might assume quite a different appearance, such as is seen in some foreign examples of de Férussac's species.

Although I have not been able to find the original of Phillips' figure, there can be no doubt of the identity of our specimens with the species described by him. Whether it is identical with de Férussac's original species is a larger question. It has been separated from it by d'Archiac and de Verneuil,¹ but these authorities assign no reasons for their view. The only point of difference which I have been able to discover is that the English specimens have a somewhat more distinct and larger umbilicus extending sometimes almost to a quarter the width of the shell. This is in every case filled with matrix, but there is every reason to suppose that it was definite, perforate, and deep. De Férussac and d'Orbigny describe it as slight, and their figures seem to represent it as small, and with less defined margins than is seen in our specimens. Sandberger, who gives figures of several varieties varying much both in the size of the umbilicus and in the fineness of the striæ, is almost the only foreign author who figures *B. striatus* with as large an umbilicus, though F. A. Römer's figure shows that one existed. In our shells, however, the mouth is in

¹ 1842, d'Archiac and de Verneuil, 'Geol. Trans.,' ser. 2, vol. vi, pt. 2, p. 353.

every case gone, and possibly if it had been preserved the umbilicus might have been found to have become more closed with age from the thickening of its sides, as is clearly the case with many of the figured specimens of de Férussac's shell. Moreover in the British Museum are some specimens of the foreign shell which accurately agree with the Devonshire fossils in the size of their umbilicus as well as in other points. It appears, therefore, that, at least until better evidence is forthcoming, Phillips must be regarded as correct in identifying our Devonshire species with the *B. striatus* of de Férussac or Bronn.

De Férussac appears to have only catalogued his shell in 1826, without describing it; but d'Orbigny gives an elaborate description of it accompanied by many beautiful figures in de Férussac and d'Orbigny's 'History of Cephalopods' (published 1835—48); and as these two authors worked in common this description may be regarded as authentic. He there shows that in its young state it is identical with *B. lineatus*, Goldfuss MS.; that in its median state it agrees with *B. striatus* as originally defined; and that in its aged state the striæ become flounced, and then it is identical with *B. undulatus*, Goldfuss MS. He gives figures of all these stages and of some intermediate forms. Of the old or flounced stage I have not as yet seen any British example. D'Orbigny doubtfully refers the species to the shell figured in 1781 by Von Hüpsch.

Bronn's *B. striatus* is evidently the same species as de Férussac's, whom, however, he does not quote before the third edition of his *Lethæa*. His figures show that the umbilicus varied in size, and is sometimes quite as large as are those of the English specimens.

A further question arises as to the name which the species ought to bear. De Férussac merely catalogued it without description in 1826. Two years after (in 1828) Fleming¹ described a very different and spirally striated shell under the same name; while a third shell is named *B. striatus* by Sowerby in 1836. Hence it appears that Fleming's species has the prior right to the name *B. striatus*, and consequently it is necessary to follow Sandberger and adopt Goldfuss' name for the present form, especially as it was given by d'Orbigny as a synonym as early as 1840.

It only remains to state that authors seem to have been in much doubt whether Bronn or de Férussac should be credited with the name *B. striatus*; thus Phillips, Sandberger, F. A. Römer, and Morris ascribe it to Bronn; and d'Orbigny, Bronn ('Index Pal.,' and 'Lethæa,' ed. 3), F. Römer, and d'Archiac and de Verneuil ascribe it to de Férussac.

Semenow and Möller² figure as *B. striatus*, de Férussac, a shell with a much more flattened back and a closed umbilicus.

B. Pelops, Hall, which in Dr. Hall's opinion is the same as *B. propinquus*, Meek,

¹ 1828, Fleming, 'Brit. Anim.,' p. 338.

² 1863, Semenow and Möller, 'Über Dev. Schicht. Mittl. Russlands,' p. 676, pl. iv, figs. 2 *a*—*c*, 3.

seems so nearly to approach the English shell in general shape and in ornament that I think it must be regarded as identical. It has a very expanded mouth, of which there is no evidence in the British specimens. Its umbilicus is very variable in size, being sometimes slight but sometimes much larger than in the latter, and in perfect specimens it is closed by the expansion of the sides of the mouth. Barrois' figure¹ of *B. Pelops* from the French Devonian comes very near our shells, and shows no expansion of the mouth, but has a very large umbilicus. Barrois notes its similarity to *B. lineatus*, Sandberger, and, if his identification of his shell with the American form is correct, it strengthens the probability of the identity of the latter with de Férussac's species.

B. affinis, de Kon., and *B. Meeki*, de Kon., seem to be so similar that I have been unable to discover any line of distinction. De Koninck's figures are not, however, very clearly individualised.

Affinities.—*B. tenuifascia*, Sowerby,² seems very like some of our more worn specimens and has a similar umbilicus, but it is distinguished, according to d'Orbigny,³ and as seen in Sowerby's type-specimen in the British Museum, by having an essentially linear, though prominent, keel.

B. Munsteri, d'Orbigny,⁴ has numerous very fine striæ and its umbilicus is closed.

B. imbricatus, Goldfuss,⁵ is not umbilicated.

B. hiulcus, Martin sp.,⁶ seems very similar. Its possession of side ridges to the keel, by which d'Orbigny⁷ distinguishes it, is of no value, as they are equally seen in *B. striatus*. However, judging from his figures, its keel is generally much broader and more coarsely marked. In one figure, on the other hand, it is very fine and narrow, and I can see nothing to distinguish that specimen from the present species. The specimen figured by Sowerby, however, shows that it is distinguished by its keel not being elevated above the rest of the shell, and by the greater rapidity of increase in its whorls.

B. costatus, Sow.,⁸ has a sharper narrower keel of a different character, and some signs of spiral ornament. It also, as seen by de Koninck's figures,⁹ seems to increase more rapidly.

¹ 1889, Barrois, 'Faun. Calc. d'Ebray,' p. 210, pl. xv, figs. 14 a, b.

² 1824, Sowerby, 'Min. Conch.,' vol. v, p. 109, pl. cdlxx, figs. 2, 3.

³ 1840, de Férussac and d'Orbigny, 'Hist. Nat. Ceph.,' p. 201, (Bellerophon) pl. i, figs. 6 and 7, and pl. v, figs. 14—18.

⁴ Ibid., p. 187, pl. ii, figs. 11—15.

⁵ Ibid., p. 195, pl. v, figs. 1—4.

⁶ 1809, Martin, 'Petr. Derb.,' p. 15, pl. xl, fig. 1.

⁷ 1840, de Férussac and d'Orbigny, 'Hist. Nat. Ceph.,' p. 196, (Bellerophon) pl. i, fig. 4; pl. iv, fig. 13; pl. v, figs. 5—8.

⁸ 1824, Sow., 'Min. Conch.,' vol. v, p. 110, pl. cdlxx, fig. 5, and 1840, de Fér. and d'Orb., 'Hist. Nat. Ceph.,' p. 198, (Bellerophon) pl. i, figs. 2, 3, 5; pl. v, figs. 9—13; pl. vi, figs. 3—5.

⁹ 1883, de Koninck, 'Ann. Mus. Roy. H. N. Belg.,' vol. viii, pt. 4, p. 135, pl. xl, figs. 1—3.

Perhaps *B. Sowerbyi*, d'Orbigny, comes closer to some of the Devonshire specimens than any other shell. D'Orbigny's figure seems just similar to one specimen in the Museum of Practical Geology, having a narrow prominent barred keel, oblique sides, large umbilicus, and grouped striæ.

B. umbilicatus, Potier and Michaud,¹ is, as re-established by de Koninck,² very similar in ornament, but has a much sharper and narrower keel and apparently a more open umbilicus.

2. *BELLEROPHON HICKSI*, n. sp. Pl. XXXI, figs. 7, 7 *a*, 7 *b*, 8, 8 *a*.

Description.—Shell rather large, globose, nautiloid, horizontally symmetrical. Spire and umbilicus deeply and equally concave, rather broadly open, showing the margins of the interior whorls. Sutures deep, acute. Whorls rising from the suture in an inward curve, and then rounding rapidly over the sides to the back, which is broad and flatly convex. Sinus-band median, narrow, elevated, slightly flattened on the back, and very slightly marked by fine, irregular striæ or growth-lines. Ornament consisting of numerous, irregularly undulating and zigzagging, elevated, sub-nodulous, rounded ridges, somewhat anastomosing and often interrupted and branching, about half the height of the keel, curving gently backwards from it, divaricating towards it, and consequently becoming much less numerous on the sides of the whorl. Mouth apparently much expanded. Shell-structure moderately thick.

Size.—A specimen in the Torquay Museum measures 17 mm. in height, and 17 in the diameter. A rather defective cast in Mr. Vicary's Collection measures about 27 mm. in height, and 31 in width.

Localities.—From Wolborough there is a fine specimen in the Woodwardian Museum which was presented by Mr. George M. Hicks; two large casts and two poor specimens retaining the test in Mr. Vicary's Collection; and another large cast in the Battersby Collection of the Torquay Museum. In the last Museum are two specimens with the shell which probably came from Lummaton or Barton.

Remarks.—These shells seem to be distinguished from *B. lineatus*, Goldfuss, by their greater comparative height, their narrower and more rounded keel, and their closer and more rounded and irregular venous-like ribs and striæ. Mr. Hicks's specimen is very fine, though probably part of the body-whorl is missing. It appears to show that the distinctive character of the striæ is maintained throughout, although they become coarser and more irregular near the mouth. The inner whorls of the

¹ 1838, Potier and Michaud, 'Galer. Moll. Mus. Douai,' vol. i, p. 5, pl. i, figs. 13—15.

² 1883, de Koninck, 'Ann. Mus. Roy. H. N. Belg.,' vol. viii, pt. 4, p. 143, pl. xxxvi, figs. 4—6.

spire seem to be hidden, at least on one side of this specimen, by a thickening of the lateral margin of the mouth. In the casts of the shell, however, the spire is well exposed on both sides.

3. BELLEROPHON MUNDUS, *Whidborne*. Pl. XXXI, figs. 9, 9 a.

1889. BELLEROPHON MUNDUS, *Whidborne*. Geol. Mag., dec. 3, vol. vi, p. 29.

Description.—Shell small, globular, horizontally symmetrical, of few rapidly increasing whorls. Shell-structure very thick. Surface with a smooth, median, flattened area in place of a keel, and with low, close, rounded, very indefinite and discontinuous ridges arching forward from it on either side. Cast with a wide median groove bounded by rounded prominences about a quarter the width of the shell apart. Mouth reniform, much recurved and very wide, being nearly four times as wide as deep.

Size.—Height of cast 13 mm., width 13 mm.

Locality.—Lummaton. A single example is in Mr. Lee's Collection.

Remarks.—This small specimen is almost entirely a cast. The surface can only be seen on a very small portion where the shell is retained; and as that has been covered by an outer whorl, it may, perhaps, have partially lost its original character. The most remarkable feature of the species is the central depression seen upon the cast, which distinguishes it from almost every other species of *Bellerophon* with which I am acquainted.

Affinities.—*Bellerophon Lohestæ*,¹ de Koninck, appears to have a much more indefinite central depression. *B. excavatus*, de Koninck,² has a similar depression, but in the centre of it there exists a small median keel of which there is no sign in the English species.

4. BELLEROPHON MACROMPHALUS, *F. A. Römer*. Pl. XXXI, figs. 10, 10 a.

1843. BELLEROPHON MACROMPHALUS, *F. A. Römer*. Verst. Harzgeb., p. 32, pl. ix, fig. 3.

1844. — — — *Beushausen*. Abhandl. Geol. Specialk. Preuss., Band vi, pt. 1, p. 44, pl. ii, fig. 1.

¹ 1883, de Koninck, 'Ann. Mus. Roy. H. N. Belg.,' vol. viii, pt. 4, p. 142, pl. xxxvi, figs. 7—9, and pl. xxxix, figs. 1—3.

² Ibid., p. 143, pl. xxxvii, figs. 6—8.

Description.—Shell of moderate size, subglobose, horizontally symmetrical. Spire and umbilicus similar, concave, wide, of few (two or three) whorls. Whorls rather rapidly increasing, especially near the mouth, long-oval in section, being highly convex on upper and lower sides, flattish inside, and moderately and decreasingly convex on the back; bearing (in the cast) a few indistinct longitudinal inequalities, one of which on the centre line of the back tends to become a sharp keel near the mouth. Mouth large, very narrow, sub-lunate. Test and surface unknown, but shell-structure probably massive.

Size.—Height about 27 mm., width 27 mm.

Localities.—There are three specimens in Mr. Vicary's Collection, and two in my Collection, from Chircombe Bridge.

Remarks.—These fossils are all internal casts and, therefore, nothing can be learnt of the character of the shell itself except inferentially. It is, however, so like the figure given by Beushausen that I have no hesitation to referring it to the same species. The restoration given by F. A. Römer of his shell is utterly unlike, having many more whorls, but Beushausen states that this is incorrect, and the fragment of the shell itself figured by Römer seems to agree with our shell.

Affinities.—It differs from *B. bisulcatus*, F. A. Römer,¹ by being larger, higher, and less trilobed, and from *B. globatus*, Sowerby,² by having a larger umbilicus, and less expanding mouth.

B. radiatus, Eichwald,³ seems somewhat similar in general shape, but its spire appears to be more open; from its general appearance I think it cannot be identical. It is covered with an elaborate ornamentation of which the English fossils preserve no trace.

B. apertus, Sowerby,⁴ which, though in England a Carboniferous shell, is quoted by d'Orbigny⁵ from the Eifel, is very similar, but it is marked with much more decided spiral elevations and depressions.

B. plenus, Billings,⁶ shows a distinct keel on the cast.

I am in much doubt whether the small shells doubtfully referred by Phillips to *B. Wenlockensis*, Sowerby, may belong to this species. As, however, they are very much smaller and appear to have a more convex back I have thought it safer not to unite them at present.

¹ 1843, F. A. Römer, 'Verst. Harzgeb.,' p. 32, pl. ix, fig. 1.

² 1839, Sowerby in Murch. 'Sil. Syst.,' p. 604, pl. iii, fig. 15, and pl. iv, fig. 50.

³ 1860, Eichwald, 'Lethæa Rossica,' p. 1074, pl. xli, figs. 1 *a*—*c*.

⁴ 1824, Sowerby, 'Min. Conch.,' p. 108, pl. cdlxix, fig. 1.

⁵ 1840, de Férussac and d'Orbigny, 'Hist. Nat. Cephal.,' p. 190, (Bellerophon) pl. i, fig. 1, and pl. iii, figs. 4—6.

⁶ Billings, 'Palæozoic Fossils,' vol. ii, pt. 1, p. 62, pl. v, figs. 8, 8 *a*, 8 *b*.

5. BELLEROPHON WENLOCKENSIS, *Sowerby*?

1841. BELLEROPHON WENLOCKENSIS?, *Phillips*. Pal. Foss., p. 108, pl. xl,
figs. 203 *a*, *b*.
1854. — HIULCUS, *Morris*. Catal. Brit. Foss., p. 288.

Remarks.—Phillips mentioned a small shell from Newton, of which he says that there is not sufficient information “to determine its true relation to forms which have been described by other authors.” “By its semiannular opening and partially disclosed umbilicus it may be compared with *B. apertus* or *B. Wenlockensis*. I give it provisionally the latter name.”

I have met with no specimens of this little shell and can, therefore, do no more than record Phillips’ descriptions. His figures show very little character. Of the accompanying shells it appears most nearly to resemble *B. macrophthalmus*, F. A. Römer, but to differ from it by having a more evenly convex back, and I have, therefore, not thought it safe to unite them until further evidence of their identity be found.

From *B. lineatus* it differs in having a larger umbilicus and no median keel.

6. BELLEROPHON IMPERFORATUS, n. sp. Pl. XXXI, figs. 11, 11 *a*.

Description.—Shell small, subglobose, horizontally symmetrical. Spire small, wholly involute and hidden by the outer whorl. Shell rather wider than high. Umbilicus wholly closed. Whorls very convex, rather flattened obliquely above and below. Mouth very large, broad and expanding, including the spire, which forms a low prominence in its centre. Lips thickened and flattened on each side, and rather excavate laterally at the points of the springing of its arch. Surface obscured.

Size.—Height 12 mm.; width about 14 mm.; depth 9 mm.

Locality.—Wolborough. There is a specimen in the Museum of Practical Geology; and another in the British Museum.

Remarks.—This small species cannot be very clearly defined on account of the pooriness of the specimens. It differs from *B. lineatus* in many particulars, as for instance in its closed umbilicus, the absence of a keel, and the larger size of the mouth; and from the specimens referred doubtfully to *B. Wenlockensis* by Phillips by its closed umbilicus.

B. globatus, Sowerby,¹ differs in having an open umbilicus and a more flattened back.

2. Genus—PORCELLIA, Léveillé, 1835.

Leveillia, R. B. Newton, 1891.

This genus is marked by its grooved or fissured back, its long narrow notch, its very open umbilicus and correspondingly depressed spire, and by its unexpanded mouth. It occurs from the Upper Silurian to the Trias.

The genus has long been well known under the name *Porcellia*, but my friend Mr. R. B. Newton, in a recently-published paper,² stating that Léveillé's name is essentially the same as *Porcellio*, a genus of Isopodous Crustacea established by Latreille in 1804, proposes the name *Leveillia* in its place. I find the opinion of those whom I have consulted to be divided as to the advisability of this change, and, as the two words although so similar are actually distinct, I do not at present see my way to adopt it. In his paper Mr. Newton gives an interesting history of this genus and of the neighbouring genus *Bellerophon*. He refers it to the Family *Pleurotomariidæ*, but it seems to be so allied to *Bellerophon* that it must follow the family in which that genus is placed.

1. PORCELLIA BIFIDA, Sandberger, sp. Pl. XXXI, figs. 12—14.

- 1841. BELLEROPHON WOODWARDII, *Phillips* (not *Martin*). Pal. Foss., p. 107,
pl. xl, fig. 201.
- ? PORCELLIA WOODWARDII, *Salter*, MS. In the Vicary Collection.
- 1853. PLEUROTOMARIA BIFIDA, *Sandberger*. Verst. Rhein. Nassau, p. 185, pl. xxii,
figs. 10, 10 a, b.
- 1854. PORCELLIA WOODWARDII, *Morris*. Catal. Brit. Foss., p. 289.
- 1867. — — — *Etheridge*. Quart. Journ. Geol. Soc., vol. xxiii,
pp. 628 and 647.
- 1889. — — — BIFIDA, *Whidborne*. Geol. Mag., dec. iii, vol. vi, p. 30.

Description.—Shell rather large, discoid, of rather rapidly increasing volutions, only slightly involute. Spire sunk so low beneath the highest point of the body-

¹ 1837, Sowerby in Murchison's 'Sil. Syst.,' p. 604, pl. iii, fig. 15; and 1840, Sowerby, 'Geol. Trans.,' pl. liii, fig. 30.

² 1891, R. B. Newton, 'Geol. Mag.,' dec. iii, vol. viii, p. 202.

whorl as to be very nearly as deep as the umbilicus. Suture deep, rectangular, facing upwards. Whorls rising steeply from the suture with a slight outward bend till they reach the highest point of the shoulder, where they curve more or less rapidly and then slope out obliquely to the widest point, where they become almost horizontal, and then curve back below in a way similar to the upper surface; the greatest width of the shell being marked by a small narrow deep channel or groove. Ornament consisting of very fine, sharp, radiating threads, separated by their own width, which rise perpendicularly from the suture, and after crossing the shoulder, where an intermediary series of similar ribs come in, diminish in size and bend gently rearwards as they approach the back.

Size.—Height 9 mm., width 28 mm.

Localities.—From Wolborough there are six fine specimens in Mr. Vicary's Collection, one in the British Museum, two in the Museum of Practical Geology, and one in my own Collection. There are twelve specimens in the Torquay Museum, some of which are from Wolborough, and some from Lummaton or Barton.

Remarks.—This shell was described by Phillips in his 'Palæozoic Fossils' as *Bellerophon Woodwardii*, Sowerby, but the identification is certainly erroneous. He made it from a single Devonshire specimen in which, as he intimates, the ornamentation was obliterated. Hence the spiral striation, which is indicated both in his figure and description, was clearly filled in from the Carboniferous shell. Though many of the specimens, which I know, are decorticated after the manner so frequent in Wolborough fossils, yet in each of the collections mentioned above are examples which preserve the sculpture, and they show distinctly that it is of a radiating and not of a spiral character. In most of these it is seen that these radiating striæ become smaller and more numerous on the outer part of the shell, though it is not quite clear whether this arises from divarication or from the rising of an alternate series of striæ. Another distinction between the Carboniferous and Devonian species is the much greater angularity of the former, so that even if the ornament had remained unknown the distinctness of the present shells, which exactly correspond with Phillips' figure, could have been easily established.

The angle at the shoulder seems to be considerably more pronounced in the older and larger specimens, and, as seen in one of the Torquay examples, the symmetry is not quite perfect, the umbilical side being slightly steeper than the upper.

It appears to be the same shell as *Pleurotomaria bifida*, Sandberger. Possibly the section of the whorls is a little more angular in the full-grown English shells, but the general appearance, the bifurcating ornament, and the variability in the coarseness of the striæ and in the angularity of the shoulder are the same in both

the English and German forms. Both Mr. T. Roberts and Mr. R. B. Newton have verified and agree with this identification.

Affinities.—*Porcellia primordialis*, Schlotheim, sp.,¹ is the species which appears to be most nearly allied to the present. It seems to be a somewhat variable form, and the question arises whether the variation is so great as to include Sandberger's species within its limits. In considering this question I have had the advantage of the help of Mr. Newton, and we both have come to the same conclusion. Schlotheim's figure of his *Ammonites primordialis* is so bad that his species can only be identified by the help of his description. F. A. Römer,² however, under the name *Bellerophon primordialis*, Schlotheim, sp., gives several figures which show that typically the species is finely cancellated, but that occasionally the spiral lines are almost invisible especially in young individuals. In his later work he figures under the name of *Schizostoma carinatum*,³ a shell which shows the spiral striping and seems to be a young example of the same species, though it appears in the figure slightly sub-discoidal. Lastly Clarke⁴ describes *Porcellia primordialis*, Schlotheim, sp., as having spiral lines, though occasionally only radiating lines are visible. In the British Museum are several German specimens of *P. primordialis* which show the spiral striæ more or less distinctly in shells of all sizes, while on the other hand there are three other fossils which exactly correspond with our specimens, and are marked only with definite radiating striæ of exactly the same character as in them. Under these circumstances Mr. Newton came to the same conclusion as myself, that the latter as well as our English species ought to be referred to Sandberger's species, and regarded as in all probability distinct from Schlotheim's shell. It is possible that Clarke included both species under one head.

Euomphalus striatus, Goldfuss,⁵ is another very similar shell. In it the radii do not seem to divaricate or increase, and the shell is less angulated and bears a small rounded keel. When Mr. Roberts and I examined it we came to the conclusion that our shells did not belong to this species, but to Sandberger's. They certainly do not belong to the genus *Euomphalus*.

Bellerophon radiatus, d'Orbigny,⁶ which that author identifies with *Porcellia retrorsa*, Münster,⁷ has rather coarser striæ, which seem to bend rather forward on the shoulder. The whorls also seem to be more definitely oval and increasing more slowly. D'Orbigny and Münster describe it as striated for three-quarters the

¹ 1820, von Schlotheim, 'Petrefact.,' p. 65, pl. ix, figs. 2 a, b.

² 1843, F. A. Römer, 'Verst. Harzgeb.,' p. 31, pl. viii, figs. 16 a—e.

³ 1850, F. A. Römer, 'Beitr.,' pt. 1, p. 38, pl. v, figs. 28 a—d.

⁴ 1884, Clarke, 'Neues Jahrb. f. Min.,' Beil.-Band iii, p. 348.

⁵ 1844, Goldfuss, 'Petref. Germ.,' vol. iii, p. 84, pl. clxxxix, figs. 15 a—c.

⁶ 1840, de Ferussac and d'Orbigny, 'Hist. Nat. Ceph.,' p. 216, (*Bellerophon*) pl. vi, figs. 20—23.

⁷ 1839, Münster, 'Beitr.,' pt. 1, p. 38, pl. ii, figs. 8 a—c.

length of the whorl, and smooth on the back, thus giving another point of distinction from ours.

Bellerophon Verneuillii, d'Orbigny,¹ is referred by de Koninck² to *Porcellia*; but, as seen both from the descriptions by these authors and from specimens in the British Museum, it is a much narrower shell, and has only coarse radii on the inner half of the whorls, the outer half or back being quite smooth. It is a Carboniferous form.

In *Porcellia tuberculosa*, Geinitz,³ as well as in *Bellerophon tuberculatus*, d'Orbigny,⁴ the longitudinal striæ are replaced by rows of tubercles.

Lastly the Carboniferous shell, to which Phillips incorrectly referred it, is easily distinguished by the very sharp angles on the shoulder and the margin of the umbilicus and by the coarse close granulation formed by impressed longitudinal and spiral striæ. It was first described by Martin⁵ as *Ammonites Woodwardii*; and its characters are distinctly shown by Sowerby⁶ who calls it *Nautilus Woodwardii*, by Phillips⁷ who calls it *Bellerophon Woodwardii*, and by de Koninck⁸ who calls it *Porcellia Woodwardii*, and are also very clearly displayed in several specimens in the British Museum.

Class—PLACOPHORA, *Jhering*, 1877.

1. *Order*—CHITONIDÆ, *D'Orbigny*, 1837.

1. *Genus*—HELMINTHOCHITON, *Salter*, 1847.

This sub-genus of *Chiton* is thus defined by Salter:⁹ “Elongate; plates as long as wide, subquadrate, thin; apex of the anal plate remote from its front edge; sustentacula widely separated; shell but very little covered by the mantle.”

¹ 1840, de Ferussac and d'Orbigny, 'Hist. Nat. Ceph.', p. 212, (*Bellerophon*) pl. vi, figs. 12—14.

² 1842-4, de Koninck, 'Descr. Anim. Foss.', p. 361, pl. xxviii, figs. 4a, b.

³ 1842, d'Archiac and de Verneuil, 'Geol. Trans.', ser. 2, vol. vi, pt. 2, p. 353, pl. xxviii, fig. 9.

⁴ 1852, Geinitz, 'Verst. Grauw. Sachsen,' p. 44, pl. xi, figs. 11, 11a.

⁵ 1809, Martin, 'Petrificata Derbiensia,' p. 17, pl. xxxv, figs. 4, 5.

⁶ 1827, Sowerby, 'Min. Conch.,' vol. vi, p. 138, pl. dlxxi, fig. 3.

⁷ 1836, Phillips, 'Geol. Yorks.,' vol. ii, p. 231, pl. xvii, figs. 1—3.

⁸ 1842-4, de Koninck, 'Descr. Anim. Foss.,' p. 360, pl. xxviii, figs. 2a—c.

⁹ 1847, Salter, 'Quart. Journ. Geol. Soc.,' vol. iii, p. 51.

1. HELMINTHOCHITON PAPILO, *Whidborne*, sp. Pl. XXXI, figs. 15, 15 *a*, 15 *b*, 16.

1889. CHITON PAPILO, *Whidborne*. Geol. Mag., dec. 3, vol. vi, p. 30.

Description.—Plate elongate, narrow, deep; posteriorly pointed; dorsally slightly convex; laterally flat and very oblique, somewhat pinched in in front; anteriorly deeply excavate, but with a broad, flat, slightly produced margin in the centre. Sides produced forwards into a kind of wing, so that the greatest length is about one and a half times that of the dorsal line. Margins of sides oblique, slightly convex, apparently bearing a small projection about half-way back, rapidly and evenly rounded in front; inner margin of the wing nearly parallel with the outer margin. Surface obliterated but apparently bearing some raised oblique lines. Shell-structure thin except in the centre, where it is thickened by an indistinct rounded internal process crossing the centre of the valve, and running obliquely down the wings. No apophyses of insertion visible.

Size.—Length of back 11 mm.; total length 16 mm.; depth 10 mm.; width 14 mm.

Localities.—There is a specimen from Wolborough in the Museum of Practical Geology, and another from Lummaton in my Collection.

Remarks.—This species is only known by two detached median valves, which are not in a good state of preservation. It appears to have been a well-marked form, distinguished by its height and narrowness, and by the development of its wings. There seem to have been several raised lines near the extremity of the wings, almost parallel with the dorsal keel. The sides meet in an acute angle on the back forming a ridge which is slightly convex longitudinally.

This description is taken from the specimen from Wolborough which is detached from matrix. My own specimen is very doubtful and indistinct, but though a little flatter it may, if a *Chiton* at all, have belonged to the same species.

Affinities.—This species seems to come in general shape about midway between *Chiton sagittalis*, Sandberger,¹ and *Chiton corrugatus*, Sandberger,² differing, however, widely from each. The former is a very much narrower shell: the latter is much broader, its posterior margins are concave, it is dorsally excavate, and it bears strong apophyses. Both species are strongly ornamented with concentric growth-striae.

Helmintochoiton Lebescontei, Barrois,³ is very similar in some respects, but differs in having much smaller wings, in the margins being almost straight instead of

¹ 1853, Sandberger, 'Verst. Rhein. Nassau,' p. 239, pl. xxvi, figs. 23, 23 *a*, 23 *b*.

² 1853, *ibid.*, p. 238, pl. xxvi, figs. 22, 22 *a*—*d*.

³ 1889, Barrois, 'Faun. Calc. d'Ebray,' p. 181, pl. xv, figs. 15 *a*, *b*.

deeply concave in front, in being slightly concave in the latero-posterior part, in having very strong apophyses, and in bearing a strong concentric ornament.

Chiton priscus, Münster,¹ from the Carboniferous, is a much shorter and more quadrate form.

Under the name of *Chiton lævigatus*, F. A. Römer, Clarke² unites the shells described by F. A. Römer as *Bellerophon expansus*³ and *Chiton lævigatus*⁴ together with *Chiton sella*, Trenkner.⁵ This species differs from the English shell in the shape of the wing, the concave postero-lateral border, the flattened back, and the concentric ornament.

Chiton trapezoidalis, Trenkner,⁶ and *Chiton gibbosus*, Trenkner,⁷ are very much wider and differently shaped forms, while the other species figured by Trenkner and reproduced by Clarke are established only on terminal valves, and therefore cannot be compared with the present fossils.

None of the Chitons figured by de Koninck at all approach it. The nearest are *Helminthochiton gemmatus*, de Koninck,⁸ which is wider, flatter, and more recurved along the back, and has smaller wings; and *H. mucronatus*, de Koninck,⁹ in which the posterior side is larger and the wings very much smaller.

¹ 1839, Münster, 'Beitr.,' pt. 1, p. 60, pl. xiii, figs. 4 *a—e*.

² 1884, Clarke, 'Neues Jahrb. f. Min.,' Beil.-Band iii, p. 337.

³ 1843, F. A. Römer, 'Verst. Harzgeb.,' p. 32, pl. ix, figs. 5 *a, b*.

⁴ 1855, F. A. Römer, 'Beitr.,' pt. 3, p. 36, pl. vii, fig. 8.

⁵ 1867, Trenkner, 'Paläont. Novit.,' pt. 1, p. 14, pl. ii, fig. 27.

⁶ Ibid., p. 15, pl. ii, fig. 32, and 1884, Clarke, 'Neues Jahrb. f. Min.,' Beil.-Band iii, p. 338, pl. iv, fig. 20.

⁷ 1867, Trenkner, 'Paläont. Novit.,' pt. 1, p. 16, pl. ii, fig. 33, and 1884, Clarke 'Neues Jahrb. f. Min.,' Beil.-Band iii, p. 339, pl. iv, figs. 12 and 13.

⁸ 1883, de Koninck, 'Ann. Mus. Royal H. N. Belg.,' vol. viii, pt. 4, p. 206, pl. li, figs. 28—31.

⁹ Ibid., p. 204, pl. li, figs. 32—35.

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— <i>laterale</i> . . .	144	— <i>centrifugus</i> . . .	263
— <i>lineatum</i> . . .	125	— <i>militaris</i> . . .	259
— — <i>var. tenuistriatum</i> . . .	125	— <i>mundus</i> . . .	261
— <i>Ludense</i> . . .	120, 152	— <i>serpula</i> . . .	263
— <i>multiseptatum</i> . . .	144	<i>Phasianella adpressa</i> . . .	159
— <i>Oceani</i> . . .	149	— <i>fusiformis</i> . . .	170
— <i>oryx</i> . . .	140	— <i>ventricosa</i> . . .	167
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— <i>rapæforme</i> . . .	121	— <i>lævis</i> . . .	239
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— <i>simplicissimum</i> . . .	144	— <i>serpens</i> . . .	241
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— <i>sp.</i> . . .	142	<i>Phragmoceras</i> . . .	111
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— <i>subannulare</i> . . .	138	— <i>unguatum</i> . . .	111
— <i>subtubicinella</i> . . .	137	<i>Phragmoceratidæ</i> . . .	111
— <i>tenuistriatum</i> . . .	124	<i>Phyllocarida</i> . . .	42
— <i>tubicinella</i> . . .	134	<i>Pileopsis compressa</i> . . .	207, 208
— <i>tubicinella</i> . . .	122, 132	— <i>prisca</i> . . .	218
— — <i>var. subnodosum</i> . . .	134	— <i>vetusta</i> . . .	213
— <i>ventricosum</i> . . .	115	<i>Placophora</i> . . .	333
— <i>Vicarii</i> . . .	129	<i>Plagiothyra</i> . . .	264
— — <i>var. eductum</i> . . .	132	— <i>archon</i> . . .	266

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<i>Platyceras costatum</i>	222	— <i>perversa</i>	267
— <i>sp.</i>	205	— <i>seminuda</i>	289
<i>Platyostoma</i>	198	— <i>Shaleri</i>	296
— ? <i>deforme</i>	200	— <i>subclathrata</i>	278
— <i>naticoides</i>	198	— <i>subimbricata</i>	293
— <i>sigmoidale</i>	198	— <i>sublævis</i>	297
— <i>speciosum</i>	202	— <i>trochoides</i>	287
<i>Pleurotomaria</i>	277	— <i>trilineata</i>	315
— <i>angulata</i>	308	— <i>Viennayi</i>	297
— <i>antitorquata</i>	235	— <i>victrix</i>	301
— <i>aspera</i>	290	<i>Pleurotomariidæ</i>	277
— <i>aspera</i>	301	<i>Polycope</i>	47
— <i>Beaumonti</i>	283, 284	— <i>Devonica</i>	48
— <i>bifida</i>	330	— — <i>var. concinna</i>	49
— <i>bilineata</i>	317	— — <i>var. major</i>	48
— <i>Bischoffi</i>	305	— — <i>var. obliqua</i>	49
— <i>Bodana</i>	292	— <i>Hughesiæ</i>	50
— <i>calculiformis</i>	305	— <i>simplex</i>	48
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— <i>delphinuloides</i>	297	<i>Proëtus</i>	20
— <i>dissimulatrix</i>	300	— <i>andax</i>	25
— <i>euomphalus</i>	296	— <i>batillus</i>	20
— <i>euryomphalus</i>	280	— <i>Champernowni</i>	23
— <i>exilis</i>	308	— <i>subfrontalis</i>	22
— <i>gracilis</i>	303	<i>Prosobranchia</i>	158
— <i>Hebe</i>	282	<i>Pseudomelaniidæ</i>	158
— <i>imbricata</i>	293	<i>Pulmonata</i>	157
— <i>impendens</i>	282	<i>Rissoa ? Lefeburii</i>	172
— <i>latevittata</i>	309	<i>Rotellina</i>	269
— <i>Lonsdalii</i>	280	— ? <i>helicina</i>	269
— <i>Lydia</i>	297	<i>Scalaria antiqua</i>	235
— <i>Melnikovi</i>	297	<i>Scalaridæ</i>	224
— <i>monilifera</i>	287	<i>Schizostoma delphinuloides</i>	297
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	PAGE		PAGE
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— <i>megalostoma</i>	231	— <i>purpura</i>	265
— <i>texatum</i>	231	Tropidocaris	44
Sedis incertæ	54	— ? sp.	44
<i>Serpula semiplicata</i>	320	Turbininæ	272
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— <i>priscus</i>	245	— <i>inamictus</i>	274
Strophostylus	197	— <i>nanus</i>	278
— sp.	197	— <i>neglectus</i> ?	276
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— <i>inornatus</i>	80	— <i>nodosus</i>	265
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Trochinæ	264	— <i>gregaria</i>	181
Trochoceras	82	— <i>obsoleta</i>	181
— <i>Foordianum</i>	83	Umboniinæ	269
— <i>obliquatum</i>	86	Velutinidæ	197
— <i>pulcherrimum</i>	86	<i>Vermetus antitorquatus</i>	235
— <i>reticulatum</i>	89	— <i>texatus</i>	231
— sp.	89	Vertebrata	1
— <i>Vicarii</i>	85		

PLATE XXV.

EUOMPHALUS FENESTRALIS, n. sp. (Page 254.)

FIG.

1. Apical view of a finely preserved specimen. 1 *a*, lateral view. Lummaton. Torquay Museum.
2. Umbilical view of another specimen. Lummaton. My Collection.
3. Umbilical view of another specimen with worn surface, figured by Phillips as *Eu. serpens*. Lummaton (?). Lee Collection, British Museum.

EUOMPHALUS GERMANUS, *Phillips*, sp. (Page 256.)

4. Phillips's type specimen. 4 *a*, lateral view. Wolborough. Museum of Practical Geology.
5. Another specimen. 5 *a*, lateral view; 5 *b*, surface of back, $\times 10$. Wolborough. Woodwardian Museum.

EUOMPHALUS ROTA, *Sandberger*. (Page 258.)

6. An elliptically coiled specimen. 6 *a*, lateral view. Wolborough. Vicary Collection.
7. Circularly coiled specimen. Wolborough. Vicary Collection.
8. Phillips's specimen, figured as *Euomphalus radiatus*, Goldfuss. Wolborough. Museum of Practical Geology.

PHANEROTINUS MILITARIS, n. sp. (Page 259.)

9. Apical view of a large specimen. Wolborough. British Museum.
10. Umbilical view of another specimen. 10 *a*, lateral view. Wolborough. Vicary Collection.
11. Umbilical view of another specimen. Lummaton. My Collection.

PHANEROTINUS MUNDUS, n. sp. (Page 261.)

12. Large specimen much obscured by matrix. Wolborough. Museum of Practical Geology.
13. Apical view of small specimen, $\times 2.5$. Lummaton or Barton. Torquay Museum.

PLAGIOTHYRA PURPURA, *d'Archiac and de Verneuil*, sp. (Page 265.)

14. Specimen, wanting apex, $\times 2.5$. 14 *a*, upper whorl, $\times 5$. Lummaton (?). Torquay Museum.

DIRHACHIS ATAVUS, n. sp. (Page 157.)

15. Specimen showing the beginning of the teeth, which become much clearer within the inner lip. Chudleigh. Woodwardian Museum.

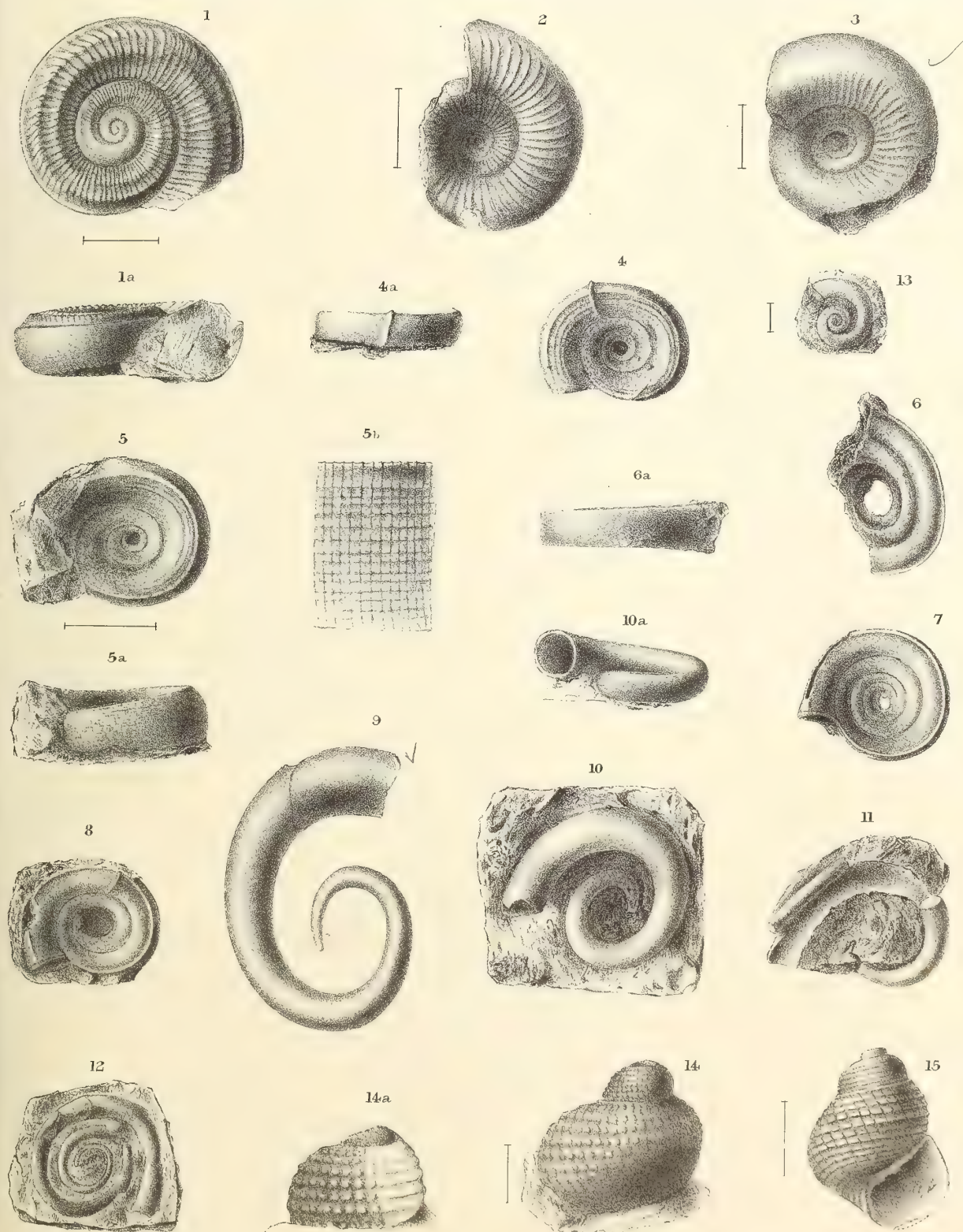


PLATE XXVI.

PLEUROTOMARIA CHAMPERNOWNI, n. sp. (Page 277.)

FIG.

1. Very elongate specimen, $\times 1.5$. Wolborough. Vicary Collection.
2. Less elevated specimen. 2 *a*, basal view. Lummaton (?). Torquay Museum.
3. Another specimen preserving the surface. Wolborough. Vicary Collection. ✓
4. Very short specimen, much worn, and wanting the body-whorl. 4 *a*, apical view. Wolborough. Vicary Collection.
5. Another much worn specimen. 5 *a*, basal view. Wolborough. Museum of Practical Geology.

PLAGIOTHYRA ARCHON, *Whidborne*, sp. (Page 266.)

6. Very large specimen, wanting the apex. [The upper whorl is merely a restoration, and not to be regarded as correct.] 6 *a*, another view, showing the tooth on the inner lip. Chudleigh. Vicary Collection.
- 7, 7 *a*. Another specimen, wanting the apex. 7 *b*, basal view, showing the tooth. Chudleigh. Vicary Collection.

LIOTIA BREVIS, *Sowerby*, sp. (Page 271.)

- 8, 8 *a*. Large specimen preserving the surface, $\times 2$. Chudleigh. Vicary Collection.
9. Another large but worn specimen. Chudleigh. Torquay Museum.

ROTELLINA (?) HELICINA, *Münster*, sp. (Page 269.)

10. Specimen retaining surface. 10 *a*, apical view. Lummaton. Woodwardian Museum.
11. Another specimen rather worn. 11 *a*, apical view. Lummaton. Torquay Museum.

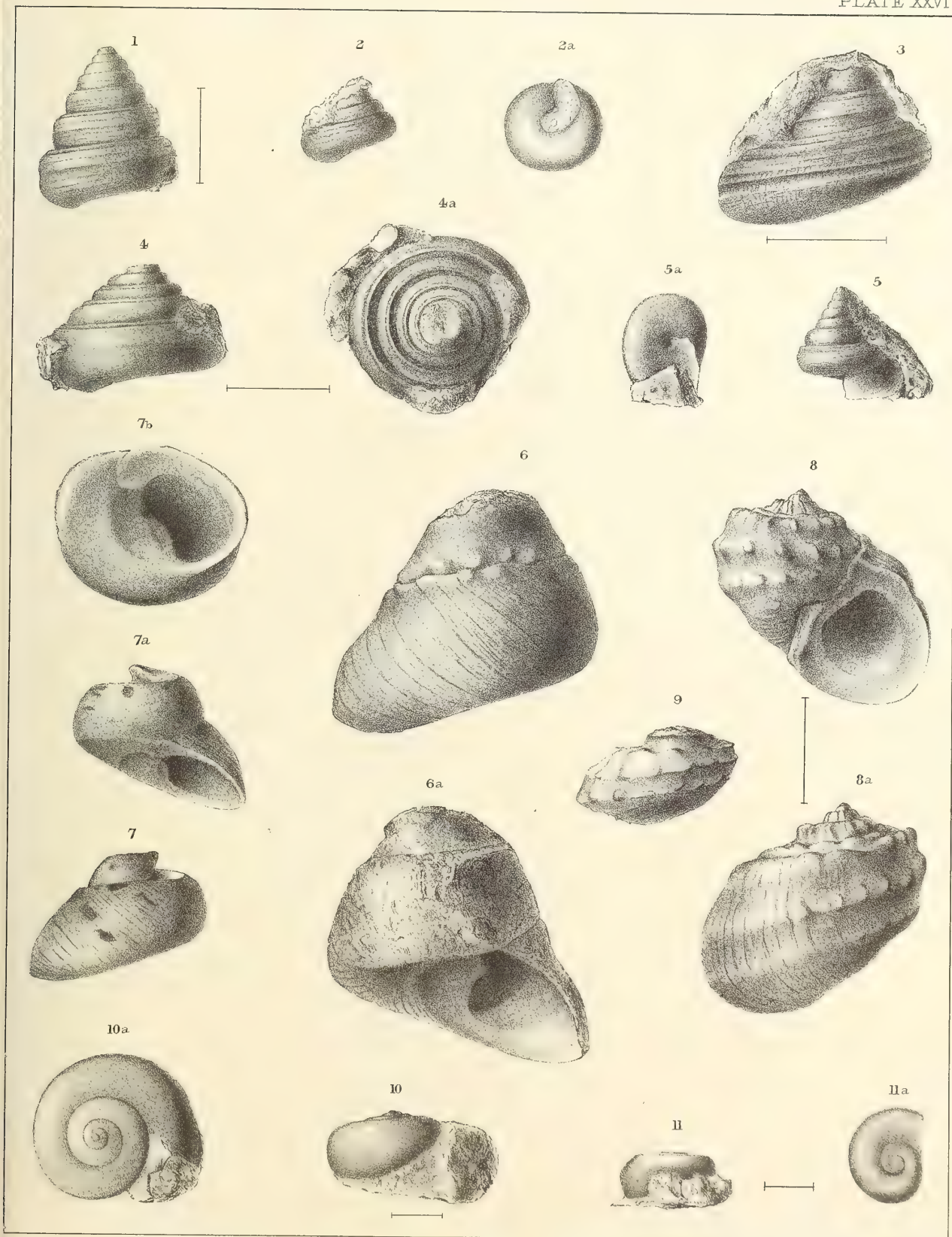


PLATE XXVII.

TURBO INAMICTUS, n. sp. (Page 274.)

FIG.

1. Decorticated specimen. Wolborough. Torquay Museum.

FLEMINGIA PERVERSA, *Whidborne*, sp. (Page 267.)

2. The largest specimen known. Wolborough. Vicary Collection.
3. Another specimen. Wolborough. Vicary Collection.
4. Another specimen. 4*a*, basal view. Wolborough. Museum of Practical Geology.

ELASMONEMA ROTUNDUM, n. sp. (Page 273.)

5. Imperfect cast. Wolborough. Vicary Collection.

TURBO CIRRIFORMIS, *Sowerby*. (Page 275.)

6. Imperfect cast. Chudleigh. Vicary Collection.

TURBO PENGELLII, *Whidborne*. (Page 274.)

7. Specimen, defective below. Wolborough. Vicary Collection.

TURBO NEGLECTUS, *Phillips*, sp. (?). (Page 276.)

8. Large specimen, defective at the base, $\times 3.5$. Lummaton (?). Torquay Museum.

PLEUROTOMARIA SUBCLATHRATA, *Sandberger*. (Page 278.)

- 9, 10. Rather worn specimens. Wolborough. Vicary Collection.
11. Smaller and more elevated specimen. Wolborough. Museum of Practical Geology.

PLEUROTOMARIA LONSDALII, *d'Archiac and de Verneuil*. (Page 280.)

12. Specimen with ornament much obscured. Wolborough. Museum of Practical Geology.

PLEUROTOMARIA IMPENDENS, *Sowerby*. (Page 282.)

13. Specimen with the ornament obliterated on the lower part of the body-whorl. 13*a*, portion of the surface of the penultimate whorl, $\times 10$. Lummaton. Champenowne Collection.

PLEUROTOMARIA ORBIGNIANA, *d'Archiac and de Verneuil*. (Page 283.)

14. Finely preserved and perfect specimen. Lummaton. Torquay Museum.

PLEUROTOMARIA NEAPOLITANA, n. sp. (Page 286.)

15. Large and finely preserved specimen. Lummaton (?). Torquay Museum.
16. Less elevated and rather worn specimen with deeper sutures. Wolborough. Museum of Practical Geology.

PLEUROTOMARIA TROCHOIDES, *Whidborne*. (Page 287.)

17. Specimen, imperfect at the base. Lummaton. Torquay Museum.
18. Smaller specimen, with wider central band. Chudleigh. Vicary Collection.
19. Aberrant specimen in which the transverse ornament is much less developed, and the base more produced. Chudleigh. Vicary Collection.

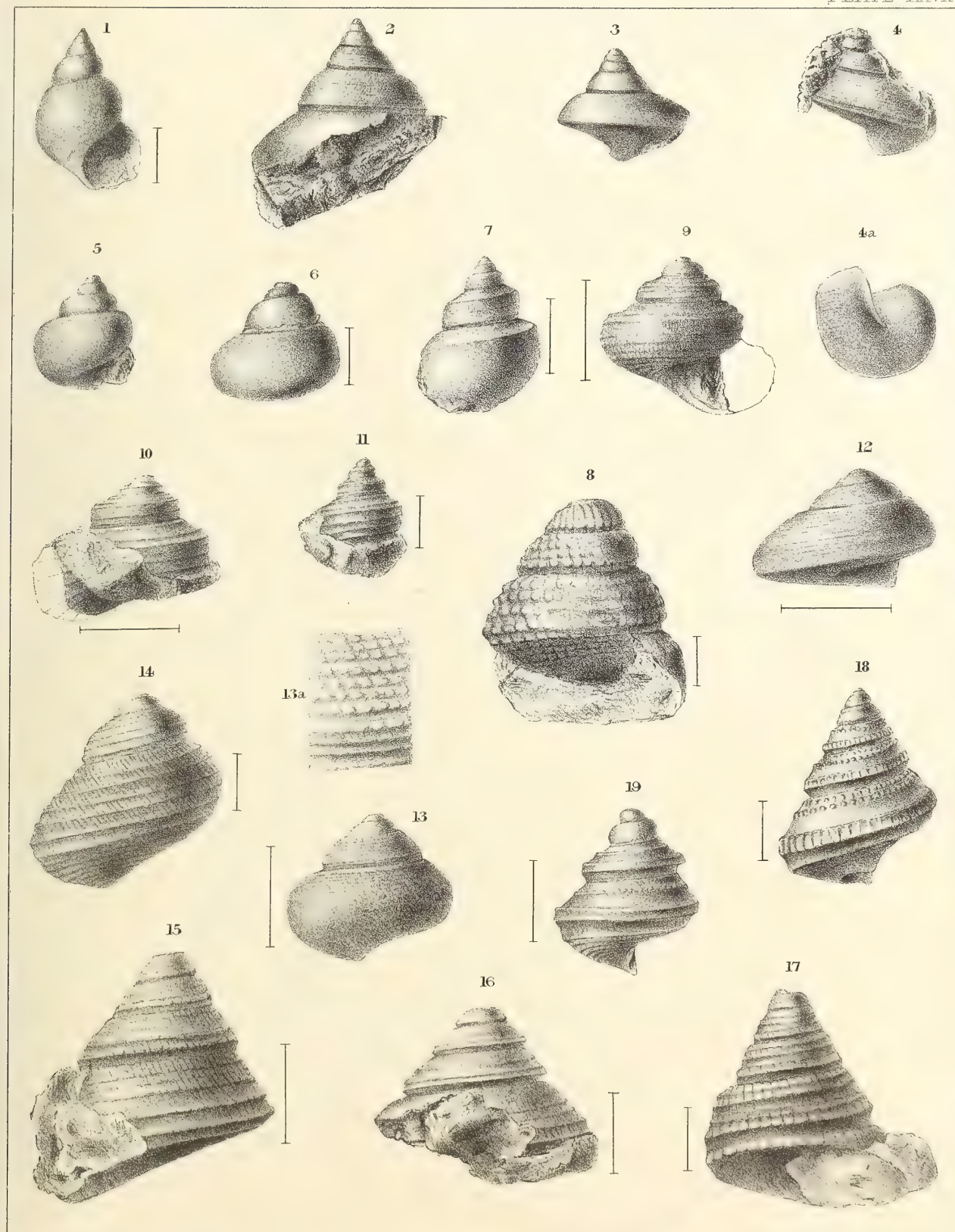


PLATE XXVIII.

PLEUROTOMARIA SEMINUDA, n. sp. (Page 289.)

FIG.

1. Specimen with surface much worn. Wolborough. Torquay Museum.

PLEUROTOMARIA CHUDLEIGHENSIS, n. sp. (Page 292.)

2. Specimen showing aperture, though injured on the outer lip. Chudleigh. Woodwardian Museum.
3. Another specimen showing the finer markings. 3 a, diagram of the surface, $\times 5$. Chudleigh. Vicary Collection.

PLEUROTOMARIA CANCELLATA, *Phillips*. (Page 291.)

4. Specimen with rather worn surface. Wolborough. Museum of Practical Geology.

PLEUROTOMARIA SUBIMBRICATA, n. sp. (Page 293.)

5. Specimen with fewer spiral threads than usual. Lummaton. Torquay Museum.
6. Typical specimen. Lummaton. Woodwardian Museum.
7. Large specimen with very fine markings, described by M'Coy as *Pl. imbricata*. Wolborough. Woodwardian Museum.
8. Large specimen slightly distorted. Wolborough. Museum of Practical Geology.

PLEUROTOMARIA SHALERI, n. sp. (Page 296.)

9. Worn and slightly distorted specimen, showing signs of coarse transverse ornamentation. 9 a, lateral view. Lummaton (?). Torquay Museum.

PLEUROTOMARIA DELPHINULOIDES, *Schlotheim*, sp. (Page 297.)

- 10, 10 a. Very large and elevated specimen. Chudleigh. Vicary Collection.
11. A still larger but more depressed specimen. Chudleigh. My Collection.
12. A small and very depressed specimen with a very broad sinus-band. 12 a, apical view. Lummaton (?). Torquay Museum.
13. A large specimen with few whorls, of unusual shape, but in many respects very similar to Schlotheim's original figure. Wolborough. Vicary Collection.

PLEUROTOMARIA CROKERI, n. sp. (Page 302.)

14. Small specimen with narrow convex sinus-band. Wolborough. British Museum.

PLEUROTOMARIA VICTRIX, *Whidborne*. (Page 301.)

15. Specimen much obscured by matrix. Lummaton. My Collection.
16. Another specimen showing ornament. Lummaton. My Collection.

PLEUROTOMARIA DISSIMULATRIX, n. sp. (Page 300.)

17. Defective specimen showing transverse folds. Wolborough. Museum of Practical Geology.

PLEUROTOMARIA GRACILIS, *Phillips*. (Page 303.)

18. Small specimen. Lummaton. Torquay Museum.

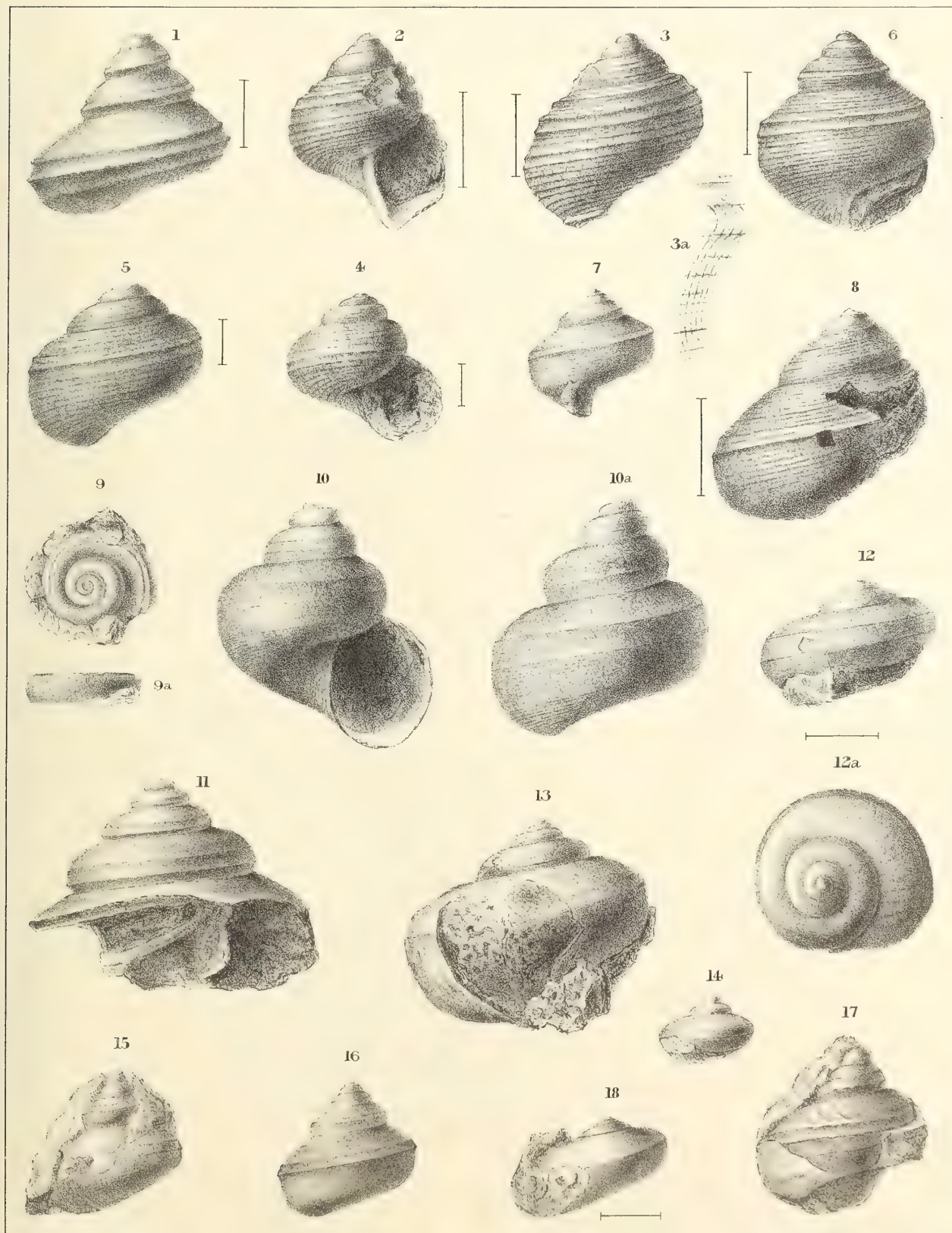


PLATE XXIX.

MURCHISONIA TURBINATA, *Schlotheim*, sp. (Page 306.)

(Groups—*spinosa*, figs. 1—10; *curta*, figs. 14—16.)

FIG.

1. Turrited specimen with foliaceous growth-striæ. Chudleigh. Vicary Collection.
2. Turrited specimen with large and distant nodules on shoulder and indistinct nodules below. Sinus-band consisting of a single keel. Chudleigh. Vicary Collection.
3. Turrited specimen with very large nodules on shoulder and very deep sutures. Chudleigh. Vicary Collection.
4. Elongate specimen with few and large nodules on shoulder and lower angle, wide sinus-band, and shallow suture. Chudleigh. Vicary Collection.
5. Fusiform specimen, with two rows of large nodules and narrow whorls. Chudleigh. Vicary Collection.
6. Very large specimen with indistinct nodules and with whorls enveloped to sinus-band. Wolborough. Vicary Collection.
- 7, 7 *a*. Two views of an elongate specimen with broad whorls and two rows of small distant nodules. Chudleigh. Vicary Collection.
8. Fusiform specimen with broad, involute whorls and few coarse elongate nodules. Chudleigh. Vicary Collection.
9. Similar but shorter specimen with very elongate ridges below. Chudleigh. Vicary Collection.
10. Similar but still shorter, conical, and more involute specimen. Chudleigh. Vicary Collection.
11. Similar but still shorter specimen, with very narrow whorls. Chudleigh. Vicary Collection.
- 12, 12 *a*. Two views of a very short, involute specimen with two rows of large nodules. Chudleigh. Vicary Collection.
13. Short involute specimen with only one row of coarse indistinct nodules, figured by Phillips as *M. spinosa*. Chudleigh. Museum of Practical Geology. (Figs. 11, 12, and 13 are intermediate forms.)
14. Similar specimen with larger body-whorl. Chudleigh. Vicary Collection.
15. Similar specimen with still larger body-whorl. Chudleigh. My Collection.
16. Similar but still shorter specimen, figured by Phillips as *M. spinosa*. Chudleigh. Museum of Practical Geology.

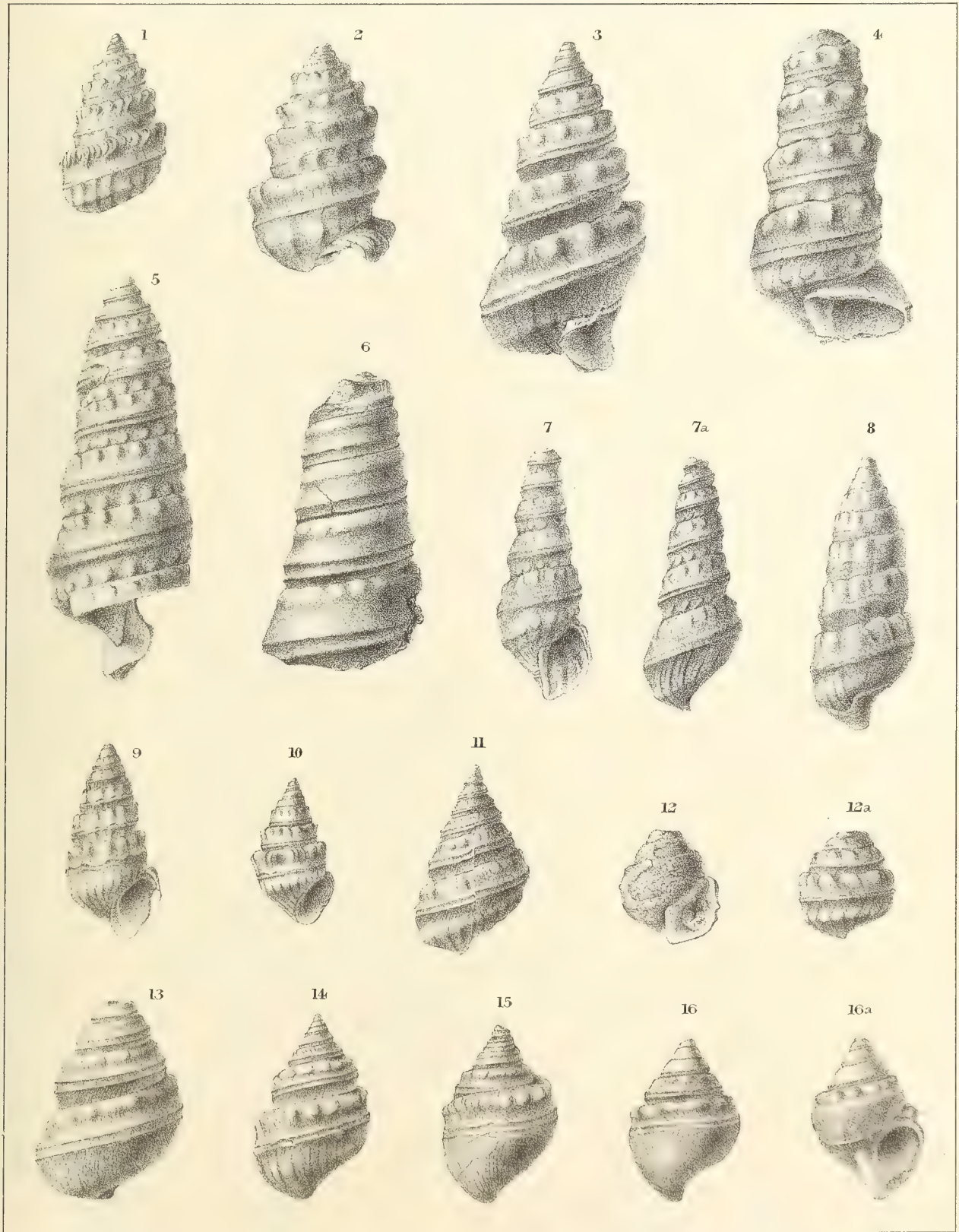


PLATE XXX.

MURCHISONIA TURBINATA, *Schlotheim*, sp. (*continued*). (Page 306.)

(*Groups—intermedia*, figs. 1—4; *angulata*, figs. 5—10.)

FIG.

1. Elongate specimen with small numerous nodules on the shoulder in the two lower whorls, smooth on the upper whorls, and with very wide sinus-band. Chudleigh. My Collection.
2. Similar but shorter specimen with more triangular whorls, only nodulated on part of the body-whorl. Chudleigh. My Collection.
3. More elongate specimen, with larger nodules and nodulated on all the whorls. Chudleigh. Vicary Collection.
4. Similar specimen, obliquely coiled. Chudleigh. My Collection.
5. Smooth and very elongate specimen with broad triangular whorls and deep sutures. Chudleigh. Vicary Collection.
6. Similar specimen, with much narrower and more numerous whorls. Chudleigh. Vicary Collection.
7. Very elongate specimen with broad whorls and wide sinus-band bounded by foliaceous ridges. Wolborough. Torquay Museum.
8. Shorter and more conical specimen. Wolborough. Museum of Practical Geology.
9. More conical specimen with very narrow whorls. Chudleigh. Vicary Collection.
10. Young specimen. Lummaton (?). Torquay Museum.
11. Specimen with narrow triangular whorls and very small nodules (intermediate to figs. 3 and 6), figured by Phillips as *M. geminata*. Wolborough. Museum of Practical Geology.
- 12, 12 a. Two views of a large specimen showing a remarkable change in character, the upper whorls being quadrate and nodulous (cf. figs. 1—4), and the lower whorls smooth and triangular (cf. figs. 5—9). Intermediate form. Chudleigh. Vicary Collection.

MURCHISONIA VICARIANA, n. sp. (Page 314.)

- 13—15. Specimens showing the double row of nodules on the shoulder and the delicate foliaceous growth-striae. Chudleigh. Vicary Collection.

MURCHISONIA TREPOMENA, n. sp. (Page 315.)

16. Specimen figured by Phillips as *M. tricincta*. 16 a, portion of whorl, $\times 3$. Wolborough. Museum of Practical Geology.

MURCHISONIA LOXONEMOIDES, n. sp. (Page 317.)

17. Specimen showing general shape. Wolborough. Torquay Museum.
18. Specimen retaining ornament. 18 a, portion of whorl, $\times 2$. Lummaton (?). Torquay Museum.

MURCHISONIA MARGARITA, n. sp. (Page 318.)

19. Very elongate specimen with at least fourteen whorls. Chudleigh. Woodwardian Museum.
20. Less elongate specimen. 20 a, whorl $\times 3$, to show the ornament. Chudleigh. Woodwardian Museum.

MURCHISONIA (?) OBESA, n. sp. (Page 319.)

21. Specimen with worn surface. Wolborough. Vicary Collection.

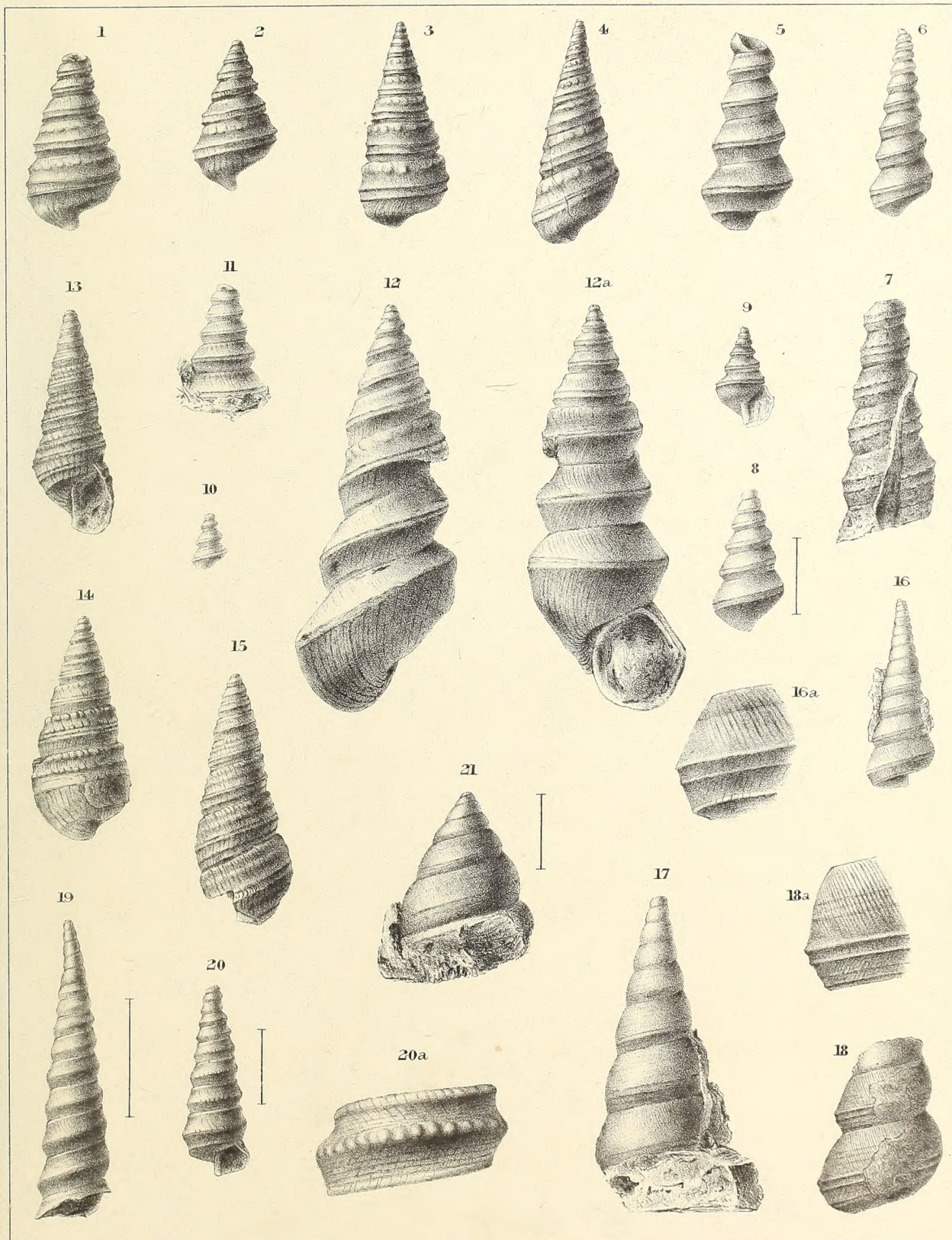


PLATE XXXI.

PLEUROTOMARIA BISCHOFFII, *Goldfuss*. (Page 305.)

FIG.

1. Specimen showing sinus-band. 1 *a*, apical view. Lummaton. Woodwardian Museum.

ODONTOMARIA SEMIPLICATA, *Sandberger*, sp. (Page 320.)

2. Specimen showing the broad sinus-band between two similar flat areas. 2 *a*, lower view. Wolborough. Torquay Museum.

BELLEROPHON LINEATUS, *Goldfuss* MS. (Page 321.)

3. Small typical specimen. 3 *a*, lateral view. 3 *b*, portion of surface, $\times 8$. Lummaton. My Collection.
4. Flatter specimen with very distant and irregular striæ. 4 *a*, lateral view. Lummaton (?). Torquay Museum.
5. Specimen with very close striæ. 5 *a*, portion of surface, $\times 7$. Lummaton (?). Torquay Museum.
6. Specimen with still closer striæ, the minor striæ having become as large as the major. 6 *a*, lateral view. 6 *b*, portion of surface, $\times 5$. Wolborough. Museum of Practical Geology.

BELLEROPHON HICKSII, n. sp. (Page 326.)

7. Specimen showing the branching striæ. 7 *a*, lateral view. 7 *b*, portion of surface, $\times 4$. Wolborough. Woodwardian Museum.
8. Large but doubtful specimen, in which the surface is destroyed. 8 *a*, lateral view. Wolborough. Vicary Collection.

BELLEROPHON MUNDUS, *Whidborne*. (Page 327.)

9. Cast, retaining only a fragment of the shell. 9 *a*, lateral view, showing the broad median sulcus. Lummaton. Lee Collection.

BELLEROPHON MACROMPHALUS, *F. A. Römer*. (Page 327.)

10. Specimen wanting shell. 10 *a*, lateral view. Chircombe Bridge. Vicary Collection.

BELLEROPHON IMPERFORATUS, n. sp. (Page 329.)

11. Specimen showing the thickened and flattened sides of the aperture. 11 *a*, lateral view. Wolborough. Vicary Collection.

PORCELLIA BIFIDA, *Sandberger* sp. (Page 330.)

12. Specimen with rather angulated whorls, worn on the back. 12 *a*, lateral view; 12 *b*, portion of surface, $\times 3$. Lummaton. Museum of Practical Geology.
13. Smaller specimen. 13 *a*, portion of surface, $\times 6$, showing the striæ, which are probably roughened by fossilisation. Lummaton (?). Torquay Museum.
14. Small specimen showing the divaricating striæ. Lummaton (?). Torquay Museum.

HELMINTHOCHITON PAPILIO, *Whidborne*. (Page 334.)

15. Worn and distorted specimen. 15 *a*, lateral view showing the obscure ornament; 15 *b*, anterior view, showing the thickening of the under side. Wolborough. Museum of Practical Geology.
16. Very obscure and doubtful specimen, which may perhaps be a Brachiopod. Lummaton. My Collection.

